

ALL INFORMATION

REGD. NO. M. 2798

Upper Third

PUBLIC LIBRARY

NOV 7 1957

Current Science

Vol. 26, No. 9

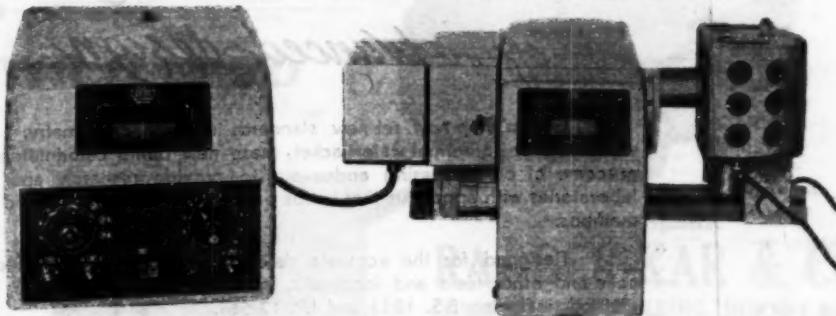
SEPTEMBER 1957

Pages 267-300

CARL
ZEISS

SPECTROPHOTOMETER

Mains-operated Model PMQ II



Made by Carl Zeiss, Oberkochen, Germany.

For precise measurements from 200 m μ in the ultraviolet to 1000 m μ in the near infrared region with high spectral resolution. Write for illustrated literature.

Sole Agents

ADAIR, DUTT & CO. (India) Private LTD.

CALCUTTA MADRAS SECUNDERABAD BOMBAY NEW DELHI

Gallenkamp
RECO.



new bomb calorimeters of advanced design

Gallenkamp now set new standards in bomb calorimetry. Available with static or isothermal water-jacket, these new bomb calorimeters are the outcome of our increasing endeavour to provide research and industrial laboratories with apparatus that keeps pace with new and improved scientific methods.

Designed for the accurate determination of calorific value of coke and other fuels and foodstuffs, in accordance with various standard methods including B.S. 1016 and I.P. 12/56T.

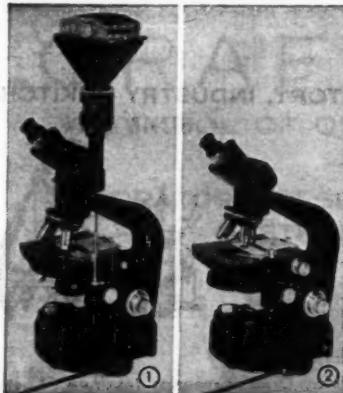
Fully informative leaflet and price list sent to all enquirers.

MANUFACTURED BY: A. GALLENKAMP & CO., LTD, LONDON, ENGLAND

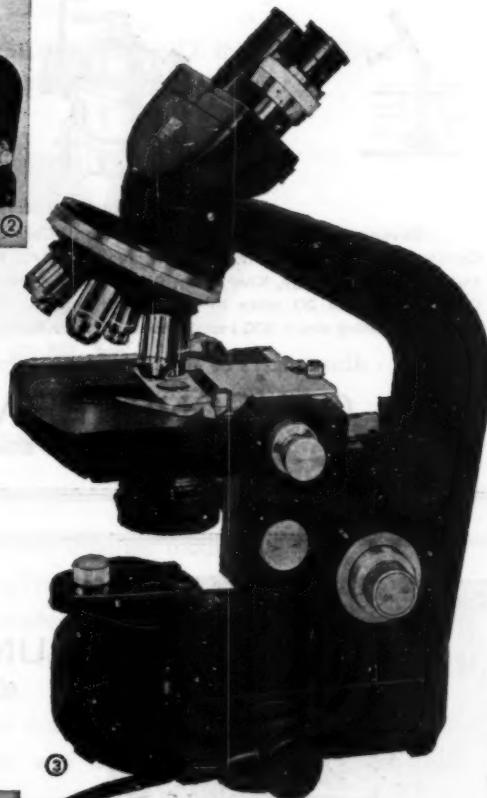
ACCREDITED AGENTS:

MARTIN & HARRIS (PRIVATE) LTD.
(SCIENTIFIC DEPARTMENT)

SAVOY CHAMBERS, WALLACE STREET, BOMBAY 1



WILD
HEERBRUGG



* The most **COMPLETE**
Microscope so far
made

* Ideal for **QUALITY**
PRECISION
& **VARIETY**

WILD M 20



The M 20 Microscope with few of its attachments

- Fig. 1: With Micro Camera and Binocular Tube;
- Fig. 2: Equipped as Phase Contrast Microscope;
- Fig. 3: With Six-Hole Nosepiece; Filter Exchanger,
etc.;
- Fig. 4: Built-in Illuminator for Kohler Illumination.

Sole Agents:

RAJ-DER-KAR & CO.
COMMISSARIATE BUILDING, HORNBY ROAD
BOMBAY-1

Telephone: 26-2304

Telegram: TECHLAB

Our Sub-Agents:

The Central Scientific Supplies Co., Ltd.
No. 2, Agaram Road, Tambaram, Madras

The Upper India Scientific Works
Morigate, Delhi



GAS PLANT

FOR LABORATORY, INDUSTRY & KITCHEN



Installed at :

Several important Laboratories, viz., Central Drug Research Institute, Lucknow, Central Salt Research Institute, Bhavnagar, Central Road Research Institute, Delhi, Indian Institute of Technology, Kharagpur, Ahmedabad Medical College and Armed Forces Medical College, besides 20 units in Travancore-Cochin, 12 in Andhra, 6 in Madhya Pradesh recently totalling about 300 installations all over India.

Also makers of superior laboratory fittings & equipment

GANSONS (PRIVATE) LTD.

P.B. No. 5576, BOMBAY 14



"MEMMERT"

UNIVERSAL OVENS

(Can be used for incubating, drying
and sterilising)

Range: 30/220° C.

(Plus or minus 0.5 accuracy in the lower range)

GERMAN CHEMICAL THERMOMETERS

in all ranges

Model T 10 with metal door

PLEASE CONTACT:

LABORATORY FURNISHERS

DHUN MANSION, VINCENT ROAD, DADAR, BOMBAY 14

GRAMS: 'LABFURNISH'
BOMBAY-DADAR

PHONE: 62761

Branch: AHMEDABAD

CRAFTSMAN

A SYMBOL OF QUALITY AND SERVICE

—FOR—

LABORATORY, RESEARCH AND INDUSTRIAL INSTRUMENTATIONS



POT-TITRATION & POLAROGRAPH

We assemble:

- * Photoelectric Colorimeter nine different models.
- * Photoelectric Filter Spectro-Photometers four models.
- * Photoelectric Flame Photometer one model.
- * Polarograph, Karl Fischer and Potentiometric Titration Unit with Automatic Burettes.
- * Thermocouples, Pyrometers and Controllers.
- * Thermostats, Relays, Water and Oil Baths, Incubators, Ovens and Furnaces.
- * Laboratory Utility Items, Hardware and Shakers.
- * Cambridge pH-meter, Pyrometers and Thermocouples.



ASK FOR DETAILED INDEX:

CRAFTSMAN ELECTRONIC CORPN. (PRIVATE) LTD.

Laboratory, Factory & Office

SETHNA HALL, NESBIT ROAD, MAZAGAON, BOMBAY 10

Phone: 42346

BS. BARGAM

PANJAB UNIVERSITY

WANTED AT HOSHIARPUR

1. Professor in Applied Mathematics: Grade Rs. 800-50-1250 (plus allowances admissible under University rules) with benefit of Provident Fund on confirmation. **Qualifications:** Essential: Eminence in the subject based on a brilliant academic career followed by research work of quality and competence to guide research. Desirable: Experience of teaching Post-Graduate Classes.

2. Reader in Statistics: Grade Rs. 510-30-750 (plus allowances admissible under University rules) with benefit of Provident Fund on confirmation. **Qualifications:** Essential: Brilliant academic career followed by research work of quality and competence to guide research. Desirable: Experience of teaching Post-Graduate Classes.

Applications stating age, present pay, academic qualifications, teaching and research experience, names of two referees, with attested copies of University certificates and testimonials, research publications, should reach:

SHRI J. R. AGNIHOTRI, M.A.
REGISTRAR
P.U., CHANDIGARH
by the 30th November 1957.

'STANDARD' POST OFFICE BOX

FOR MEASUREMENT OF RESISTANCE
FROM 0.01 OHM. TO 1 MEGOHM

COILS OF MINALPHA WIRE
ACCURACY OF ADJUSTMENT 0.1%

DIAL TYPE, WITH PUSH-BUTTON
CONTACT KEYS INCORPORATED

Manufactured by :

THE STANDARD SCIENTIFIC
INSTRUMENTS Co.
MADRAS 28

JOURNAL OF THE ZOOLOGICAL SOCIETY OF INDIA

Published bi-annually, containing original
papers and reviews in all branches of Pure and
Applied Zoology

*Annual subscription per volume of
two issues*

Foreign: Rs. 22

India: Rs. 20

A few back numbers are also available,
subject to prior sale.

A few pages are reserved for advertisements
at rates available from the Honorary
Treasurer.

Reprints of a few papers of the Indian
Helminthologist, the (late) Dr. G. D. Bhale-
rao, and the Indian Journal of Helminthology
could also now be had from the Office of the
Honorary Treasurer, Dr. B. S. Chauhan, 34,
Chittaranjan Avenue, Calcutta 12, India.

All orders, remittances and communications
regarding above should be addressed to the
Honorary Treasurer.

TURTOX

**PLEDGES ABSOLUTE SATISFACTION IN
BIOLOGICAL SUPPLIES**

PRESERVED MATERIALS

BOTANICAL MATERIALS

DEMONSTRATION PREPARATIONS

PLASTIC MOUNTS

SKELETAL PREPARATIONS

ANATOMICAL MODELS

BIOLOGICAL MODELS

BIOLOGICAL CHARTS

KEY CARDS

QUIZ SHEETS

MICROSCOPE SLIDES

LANTERN SLIDES

APPARATUS

Sole Agents:

GORDHANDAS DESAI PRIVATE LTD.

SIR PHEROZESHAH MEHTA ROAD

BOMBAY 1

**P7, MISSION ROW EXTENSION
CALCUTTA 1**

**42/B, ASAFA ALI ROAD
NEW DELHI**

**22, LINGHI CHETTY STREET
MADRAS 1**

A Monumental Work

Published March 1956

A book that should find place on the shelves of every library

**HISTORY OF CHEMISTRY
IN ANCIENT & MEDIEVAL INDIA**

Incorporating

HISTORY OF HINDU CHEMISTRY

By

ACHARYA PRAFULLA CHANDRA RAY

Edited by

Prof. P. RAY

Royal 8vo., Rexin bound, 494 pages, with 39 illustrations

Price ex-postage :

**Prime Edition : Rs. 24 (Inland), for Fellows Rs. 20
£ 2 or \$ 6.00 (Foreign)**

Ordinary Edition : Rs. 20 (Inland), for Fellows Rs. 16

An invaluable book for students of science and history and for all persons interested in the scientific heritage of India

Published by the

INDIAN CHEMICAL SOCIETY

**92, UPPER CIRCULAR ROAD
CALCUTTA 9, INDIA**

SOME OPINIONS

Nature, January 5, 1957

"..... Since there is much new material in the book, all those who are fortunate enough to have the earlier edition will wish to have the new one.....

"All those interested in the History of Chemistry owe a deep debt of gratitude to Prof. Ray and the Indian Chemical Society for its publication."

J. Chemical Education, February 1957

"..... Professor Ray, in his carefully constructed revision of Prafulla Chandra Ray's standard 'History of Hindu Chemistry', has given us a highly informative and interesting description of Indian Chemistry. In chronological order, the contributions of Indians to chemistry have been recorded from the Harappa period of the fourth millennium B.C. to the end of Mogul culture.....

"..... Many of the ideas described make delightful reading for the average chemist with a historical bent..... chemists and historians of chemistry will find in this book a valuable assessment of ancient Indian Chemistry and culture."

ANNUAL REVIEW OF

BIOCHEMISTRY

Vol. 26

July, 1957

Prefatory Chapter—Forty-five Years of Biochemistry, *R. Peters*

Biological Oxidations, *H. R. Mahler*

Nonoxidative, Nonproteolytic Enzymes, *S. Schwimmer*

Proteolytic Enzymes, *B. J. Jandorf and H. O. Michel*

Metabolism of Lipides, *E. P. Kennedy*

Carbohydrate Metabolism, *C. de Duve and H. G. Hers*

Water-Soluble Vitamins, Part I, *J. R. Totter*

Water-Soluble Vitamins, Part II, *L. D. Greenberg*

Water-Soluble Vitamins, Part III, *G. D. Novelli*

Fat-Soluble Vitamins, *K. L. Blaxter*

Nutrition, *O. W. Portman and D. M. Hegsted*

X-Ray Studies of Compounds of Biological Interest, *J. C. Kendrew and M. F. Perutz*

The Chemistry of Proteins, *D. Steinberg and E. Mihalyi*

Amino Acid and Protein Metabolism, *H. Kamin and P. Handler*

The Nucleic Acids, *W. E. Cohn and E. Volkin*

Biochemistry of the Steroid Hormones, *R. I. Dorfman*

Haem Pigments and Porphyrins, *C. Rimington*

Clinical Applications of Biochemistry, *J. G. Reinhold*

Biochemistry in the U.S.S.R., *J. A. Stekol*

Chemistry of the Carbohydrates, *J. C. Sowden*

The Biochemistry of Muscle, *H. H. Weber*

768 pages

each \$ 7.50 postpaid

Approx. 520 pages

Annual Reviews, Inc., Grant Ave., Palo Alto, Calif., U.S.A.

Maruzen Company, Limited, 6 Tori-Nichome Nihonbashi, Tokyo, JAPAN

PHYSICAL CHEMISTRY

Vol. 8

September, 1957

Thermochemistry and Thermodynamic Properties of Substances, *E. F. Westrum, Jr.*

Cryogenics, *C. F. Squire*

Solutions of Electrolytes and Diffusion in Liquids, *R. A. Robinson and R. H. Stokes*

Solutions of Nonelectrolytes, *Z. W. Salsburg*

The Solid State, *J. A. Krumhansl*

Nuclear and Electron Magnetic Resonance, *H. M. McConnell*

Radiation Chemistry, *W. M. Garrison*

Quantum Theory, *J. W. Linnett and P. G. Dickens*

High Polymers in Solution, *J. J. Hermans*

Kinetics of Polymerisation, *F. W. Peaker*

Surface Chemistry and Contact Catalysis, *B. S. Rabinovitch and J. H. Singleton*

Electrode Processes, *P. Delahay*

Kinetics of Reactions in Gases, *H. S. Johnston*

Kinetics of Reactions in Solution, *E. L. King*

Organic Reaction Mechanisms, *J. D. Roberts, G. S. Hammond and D. J. Cram*

Molecular Electronic Spectroscopy, *Th. Förster*

Vibration-Rotation Spectroscopy, *W. F. Edgell*

Experimental Molecular Structure, *P. J. Wheatley*

Combustion and Flames, *H. G. Wolfhard and D. S. Burgess*

The Physical Chemistry of Proteins, *W. Kauzmann*

Bond Energies, *A. H. Sehon and M. Swarc*

Ion-Exchange Resins & Membranes, *H. P. Gregor*

ULTRASONIC, ELECTRONIC AND ELECTROCHEMICAL EQUIPMENT

Ex: Messrs. MULLARD OVERSEAS Ltd., ENGLAND



CONDUCTIVITY BRIDGE E. 7566

This is a direct-reading Conductivity Bridge covering the range 0.1 micro-mhos - 10 mhos. and having an accuracy of 3-5%. An inner scale reads 1-100 ppm-sodium chloride.

The instrument is a modified wheatstone bridge operating at 3 Kc/s. Measurement at 3 Kc/s. avoids polarisation errors. When used with the comparison cell E. 7591 automatic temperature compensation is provided.

The balance detector is a cathode ray tuning indicator (magic eye), forming a sensitive and inertialess system.

The Conductivity Bridge is self-contained in a robust compact case and completely mains operated. It can be used by unskilled personnel.

Other Instruments

Conductivity Controller; Temperature Controller; Ultrasonic Generators, Drills and Soldering Equipment; Valve Voltmeters; Oscilloscopes, etc.

SOLE AGENTS:

TOSHNIWAL BROS. (PRIVATE) LTD.
198, JAMSHEDJI TATA ROAD, BOMBAY I

Branches:

9, Blaker's Road, Mount Road P.O.
MADRAS 2

31, Ballygunge Place
CALCUTTA 19

14 B/4, N.E.A., Uttari Marg
NEW DELHI 5

Current Science



Vol. XXVI]

SEPTEMBER 1957

[No. 9

	PAGE		PAGE
<i>The International Geophysical Year—</i> S. RAMASESHAN	267	<i>Preliminary Observations on the Pharmacological Actions of Various Fractions of Nardoctachys jatamansi—DC.—B. C. BOSE, S. S. GUPTA, R. VIJAY-VARGIYA, A. Q. SAIFI AND J. N. BHAT-NAGAR</i>	278
<i>W.H.O. Report on Radiation Hazard</i> ..	270	<i>The Origin of the Aurora</i>	280
<i>Jets, Waves and Cavities</i>	271	<i>A New Type Particle Accelerator</i>	281
<i>The Encyclopedia of Chemical Technology</i>	273	<i>Letters to the Editor</i>	282
<i>Viruses in Search of Disease—N. VEERA-RACHAVAN</i>	274	<i>Reviews</i>	294
<i>Radiation Controls Titanium Furnace</i> ..	275	<i>Science Notes and News</i>	299
<i>Ultraviolet Absorption Spectra of Mono-substituted Benzenes—C. N. RAMA-CHANDRA RAO</i>	276		

THE INTERNATIONAL GEOPHYSICAL YEAR

ERATOSTHENES measured the earth; Cavendish weighed it. These were perhaps the earliest of the great geophysical experiments on which man was to launch upon. Indeed, Gilbert's concept of the earth as a giant magnet, Halley's charting of the trade winds, the ascent of Gay Lussac and Biot in a balloon to investigate the chemical composition of the atmosphere, the discovery by Kennelly and Heaviside of the ionosphere, the detection of the jet stream in the upper atmosphere, Störmer's theory of charged particles from the sun causing the auroræ, the theory of isostasy and Wegener's theory of drifting continents, appear to have been taken from the pages of a fairy tale. This year, scientists of more than 70 nations are joining together to make a concerted effort to get a better knowledge of our planet, the earth. Unlike the two previous attempts in 1883 and 1932 when most of the studies were confined to the polar regions, the

present effort, which is on a very much larger scale, will involve not only the poles but the whole earth including the land, the oceans, the atmosphere and the multifarious solar phenomena which have such a great influence on our lives. However, a balanced evaluation of the general programme indicates that the activities to be carried out on and beneath the surface of the earth will be overshadowed by the explorations of the lower and higher atmosphere.

THE GLOBAL ASPECTS OF THE I.G.Y.

The duration of the International Geophysical Year (I.G.Y.) is from the 1st of July 1957 to 31st December 1958, this period having been chosen because of the intense sunspot activity that is expected during it. Extensive observational data are to be collected in the fields of meteorology, glaciology, oceanography, seismology, gravimetry, latitude and longitude

measurements, solar activity, geomagnetism, air-glow, auroral displays, ionospheric behaviour and cosmic ray physics. Effecting a proper correlation between the data in the different disciplines would be one of the most difficult tasks which the organisers of the I.G.Y. have to face. This all-important co-ordination will be attempted at different levels by a series of committees. Apart from the observations to be made in more than 2,000 permanent stations spread round the world, more than 1,000 new observational points have been scheduled. For the distribution of the I.G.Y. stations, clearly defined areas have been selected based on existing scientific conditions. Special emphasis will be put on the arctic and antarctic regions. Measures are being taken to establish a large number of stations in the equatorial belt and the tropic zone where the observational coverage during the past has been insufficient. Four special meridians (80° W., 10° E., 75° E., and 140° E.) have been chosen where a dense net of observation points are being situated. Additional observations from ships and special units have also been envisaged.

In addition to the routine recording of all interesting geophysical data, there will be about 60 "regular world days" when special extensive investigations are scheduled. Whenever any unusual ionospheric, magnetic, auroral or meteoric activity is expected, an "alert" will be given and different stations will start making special observations for specified intervals. There will also be six "world meteorological intervals" of ten consecutive days each, during which observations of meteorological interest will be made.

The programmes that are contemplated are so ambitious and the preparations that are being made are so elaborate that it would be impossible to even mention them in a single article like this.

METEOROLOGY AND RELATED SUBJECTS

The meteorological programme of the I.G.Y. stresses the need for the systematic exploration, on a worldwide scale, of the upper troposphere and the stratosphere and it lays down that the investigations should be devoted to large-scale physical, dynamic and thermodynamic processes connected with general circulation. Studies should be particularly directed to elucidate the redistribution in the atmosphere on a planetary scale, of momentum, absolute vorticity, entropy and various forms of energy. Large-scale influence of friction and surface topography, heat and momentum interchanges between the atmosphere and the con-

tinents and the ocean, etc., will also be subjects of study. The programme of observation will consist of the daily routine recording of the synoptic data on land and on board vessels. Each recognised station will make two radio soundings, preferably upto the 10 mi. level (by balloons), of the pressure, temperature and the humidity and will make four radio-wind observations.

One of the important series of measurements to be made will be those on heat or radiation balance. For these the recognized procedure will be supplemented by the use of radiometers recently developed for measuring the difference between the incoming radiation and that reflected back by the earth's surface.

Nuclear radiation in the atmosphere is to be measured. This would help in determining whether there is any direct correlation between rain and radioactivity. These measurements would also help to identify large masses of air making it possible to draw up on a planetary scale the trajectories of the synoptic air particles. It is hoped that all these meteorological studies may also prove useful in exploring the possibilities of artificial climate control and the development of the arid regions.

World climate is known to be influenced by the cover of snow and of ice on the earth's surface and the melting of even a fraction of this cover may submerge large portions of dry land. It is well known that the glaciers are retreating and the sea-level is rising. The I.G.Y. programme of glaciological studies includes special seismic methods for estimating the thickness of the ice and the recording of the present glacier topography. To define the geography of the underlying coast is also one of the prime purposes of these studies.

The melting of the polar snows is closely connected with the general circulation of water. A large number of ocean survey vessels will be used for these investigations. Of particular interest will be the study of the shifting boundaries between temperate and polar waters and the transfer of energy across the equator.

GRAVIMETRY AND SEISMOLOGY

Worldwide contributions are expected during the I.G.Y. to the problem of the tides experienced by the solid earth. Under the influence of gravitational forces of the moon and the sun, the earth undergoes tidal movements comparable to those of the sea; the amplitudes of the movements being of the order of ± 20 cm and they can be measured by accurate gravimeters and horizontal pendulums.

A network of well-distributed seismological stations will provide continuous seismic data

be sub-
servation
ording
ard ve-
ake tw
e 10 mb
tempera-
ake fo
urement
radiation
rocedure
f radio-
ring the
ation and
face.
re is
ermining
between
urement
es of all
planetary
air par-
rological
ring the
l and in
nced by
the earth
ction of
s of dr
liers are
. The
dies in
timating
ording
fine the
also on
.
close
of water
els wi
particula
bound
ters an
or.
l durin
experi
nfluenc
and th
ents com
itude
± 20 c
e gravit
nologic
nic dat

all over the world. Data from some of the seismological stations will include microseismic observations which are related to the tides and storm surges in the sea.

It is, however, significant that the suggestion put forward by some eminent seismologists that the earth's interior structure may be studied by exploding atom bombs has been turned down by the Special Committee of the I.G.Y. Programme on the grounds that there was no wish on the part of this body to be associated with a tool of such sinister and diabolical reputation.

Thirty-nine observatories will establish the exact position of certain selected stars during the I.G.Y. It is hoped that these extensive observations will give the exact geographical locations of the observatories, the short period and secular irregularities in the earth's rotation and corrections to the position of the stars given in the nautical almanacs.

SOLAR RESEARCH AND TERRESTRIAL PHENOMENA

It is but natural that considerable effort should be put into solar research during the I.G.Y. Satisfactory international co-operation already exists in solar research. During the I.G.Y. it is proposed to extend the observations made by the different observatories to establish a still closer co-operation between them. The study of the sun will consist of the recording of the sunspots, measurements of the intensity of the magnetic field near their vicinity by Zeeman effect studies, and obtaining also the general magnetic field of the sun, observations of solar flares, a continuous spectroheliograph, coronograph and solar radio noise records.

The ultraviolet radiations from the sun on entering the earth's atmosphere converts some of the oxygen in it to ozone, and the ozone layer in the atmosphere is of great interest from the point of view of the upper air physicist. Very accurate measurements of the horizontal and vertical distribution of ozone are to be made during the I.G.Y. using spectrographic methods, or by methods based on the observations of lunar eclipses or observation of stars.

Even at night it is found that the upper atmosphere over the whole earth continuously emits a feeble light. This is known as the airglow and it derives its energy from the store accumulated during the day when solar ultraviolet light ionizes and dissociates the atmospheric gases at great heights. The spectrographic studies of the airglow are expected to reveal the mechanisms of dissociation and recombination that are taking place in the upper

POLAR AND TROPICAL AURORÆ

An occurrence of an intense flare on the sun's disc is followed almost simultaneously by a short wave radio fade out and a small but sudden disturbance in the earth's magnetic field. These effects are probably caused by the ultraviolet light from the flare reaching the earth. Twenty-seven hours later, there occurs a spectacular aurora visible widely over the earth together with a magnetic storm. The delay in the occurrence of these phenomena is explained as due to their being caused by a stream of material particles ejected by the sun at the time of the flare. This delay also permits the sending of adequate warnings to the different auroral stations. Work on the auroræ will in the main be concentrated around the auroral zone (67° N. and S.). By radar and parallax methods the height of the auroral display will be determined. Progress of an aurora will be continuously recorded by "all sky" cameras. The photographs from these cameras and radar scopes will be compared with those obtained on synchronously paired equipment in both the northern and southern hemispheres.

It is perhaps worthwhile to mention that the displays of the aurora are not confined to the polar regions alone. Indeed bright displays have been noticed in as low latitudes as Bombay and Singapore. But unfortunately no adequate observations of tropical auroræ are available. It would, therefore, be extremely valuable if persons, not necessarily formally associated with the I.G.Y. living in tropical regions, record accurately the form of any unusual luminosity that may be seen in the night sky.

During the I.G.Y., more than 100 new geomagnetic stations will be set up all over the globe which will continuously record the different magnetic elements of the earth. The I.G.Y. rocket measurement of the geomagnetic effects will also contribute to our understanding of the magnetic properties of the earth.

All the tremendous developments that have taken place in electronics after the war will be made use of in the study of the ionosphere. The practical applications to radio propagation will prove a great impetus for many of these investigations. The heights of the different ionospheric layers and their diurnal and long-term oscillatory movements, their fine structure, their absorption, reflecting, double refracting and scattering properties for waves of different wavelengths, will form some of the subjects for extensive investigations. The study of radio echoes as meteors enter the ionosphere will all

be undertaken. Researches in Radioastronomy and Cosmic Ray Physics, which have become so important during the post-war years, will be intensified during the I.G.Y.

ANTARCTIC RESEARCH

The knowledge about the great continent of Antarctica is so meagre but its influence on world climatology is so great that it has been decided to make it the scene of many scientific activities during the I.G.Y. Hidden behind these scientific goals also lie economic and political possibilities. On Antarctica more than twelve nations are establishing about thirty stations equipped with the most modern scientific equipment and these will be able to collect an enormous knowledge about this strange continent. One of these stations is to be situated right on the south pole and another on the magnetic pole.

ROCKET AND SATELLITE PROGRAMME

Scores of rockets are to be sent up to probe the mysteries of the upper air and some of them are expected to reach the auroral regions. U.S.A., Britain, France, Japan, Australia and U.S.S.R. have all joined in what will be one of the most complicated and expensive programmes of the I.G.Y.

But by far the most spectacular of all will be the I.G.Y. satellite programme. Both the U.S.A. and the U.S.S.R. expect to launch small satellites by means of rockets into space during the I.G.Y. The scientific instruments they will carry will send back by radio, atmospheric and cosmic data. The first American satellite will be about 50 cm. in diameter weighing about 10 Kg. travelling at about 28,000 km. p.h. in an elliptic orbit inclined to the equatorial plane of the earth at approximately 40°. It is expected to circle the globe every 90 to 100 minutes. Comparatively little news is available about the Russian satellite except that it may be slightly larger than the American one. It is also likely that the Russians will try to achieve a polar orbit of some kind.

W.H.O. REPORT ON RADIATION HAZARD

THE authoritative report of the study groups on the Effect of Radiation on Human Heredity was published recently by the W.H.O. Headquarters, Geneva. The report declares that all man-made radiation must be regarded as harmful to man from the genetic point of view. Most genetic effects are very closely additive and small amount of radiation received by a large group of individuals can do an appreciable damage to the population as a whole.

A rather heartening part of the programme is that the geophysicists of U.S.S.R. and U.S.A. have agreed that both their satellites will transmit messages exactly on the same frequency (108 mc.). This will mean that the costly radio tracking equipment present at any one of the "Moonwatch" stations can equally well used for both the U.S. and U.S.S.R. satellites. The optical track of the satellites will be kept by specially designed Schmidt cameras (mirror diameters 75 cm. f-50 cm.) which have a crystal clock incorporated in them. Precision observations of the tracks with these are expected to yield information about the density of the air, shape of the earth, etc. The programme of measurement by the first U.S. satellite will include the measurement of atmospheric temperature, air density, meteor penetration and surface erosion, the intensity of the U.V. and X-radiations from the sun. If the first satellite is a success a very much more ambitious programme of observation has been planned.

INDIA'S CONTRIBUTION

India, in her own small way, will contribute her share to the I.G.Y. programme. She will be having twelve radio wind and radio sonic stations and about 50 balloon stations for the upper wind studies, three storm detecting units, four radio noise laboratories. Exhaustive studies of the radiation balance will be made at four stations and spectrographic studies of the air glow will be made at six observatories; eight auroral watch posts have been established. A network of geomagnetic and seismological units are already in existence and many centres of higher learning are co-operating in obtaining cosmic ray data. Himalayan glaciers will be extensively studied and a number of coastal ports will make oceanographic observations. The solar observatory at Kodaikanal will be continuously studying the sun during the I.G.Y. Nainital has been selected as the "Moon-watch" station, its complete astronomical equipment being a gift from the United States of America.

S. RAMASESHAN.

The sources are: (1) X-ray tubes and nuclear reactors, and (2) artificial radioactive elements distributed by man in nature. The report outlines certain precautionary measures, and stresses the intelligent use of diagnostic and therapeutic X-rays or radio-isotopes so that their benefits may be at a maximum and any possible long-term genetic hazards are reduced to a minimum.

Again
Liquid
The
caviti

* Je
E. H.
New Y

JETS, WAKES AND CAVITIES*

BY a jet is meant a stream of material which travels for many diameters in a nearly constant direction. Water issuing from a nozzle under pressure is the most familiar example, but we can also have gas jets in air and water jets in water, and they are also important. The spectacular recent development of jet-propelled aircraft is familiar to all. Very recently also, meteorologists have become aware of jet streams of air in the stratosphere travelling with a velocity of a few hundred miles per hour.

When an obstacle or barrier is held stationary in a moving stream, the flow usually separates from the obstacle along the so-called separating stream lines. The fluid between these stream lines constitutes the wake. Just behind the obstacle it is relatively peaceful. But far behind it, it consists of a train of eddies.

In the case of high-speed motion through a liquid, the wake becomes gaseous. Such a wake is called a cavity. For example, if a sphere is dropped into water at speeds of 25 ft. per second or more, an air-filled cavity is formed (Fig. 1).

different points of view and are of high practical importance. For example, wakes are important because they represent the main source of real fluid resistance or drag; no resistance would normally occur in a non-viscous fluid at sub-sonic velocities if it were not for flow separation and the attendant wake. The formation of vapour-filled cavity bubbles raises serious problems in marine propellers and in hydraulic turbines. Remarkably enough, the phenomenon had been anticipated in the eighteenth century by Euler.

The fascinating and complex field of fluid dynamics presented by jets, wakes and cavities have interested investigators who approached the subject from different points of view, viz. pure mathematicians, applied mathematicians, hydraulic engineers and finally physicists, and their investigations from these diverse points of view have been fruitful. As a remarkable instance, it may be mentioned that the study of the *œolian* tones arising from the motion of air over thin rods gave

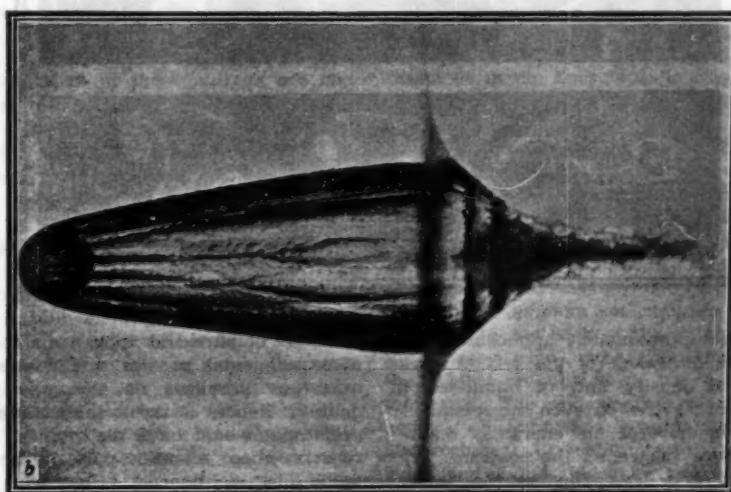


FIG. 1. Cavity behind sphere dropped in water.

Again, if an obstacle is held in a stream of liquid moving at high speed, a vapour filled cavity is formed.

The phenomena presented by jets, wakes and cavities are of great interest from several dif-

the first indication that we had to do with a periodic phenomenon which was later identified with the formation of parallel rows of regularly formed vortices behind the cylinder.

The book under review attempts to bring together into a co-ordinated whole the works of these various groups of specialists. It is devoted to the quantitative scientific analysis of jets, wakes and cavities. Wherever possible, an

* *Jets, Wakes and Cavities*. By G. Birkhoff and E. H. Zarantonello (Academic Press, Inc., Publishers, New York), January 1957. Pp. 354. Price \$ 10.00.

attempt is made to predict their behaviour by solving an appropriate boundary value problem, using the partial differential equations of fluid motion. In the case of liquid-jets in air and of cavity flow, this programme can be carried through successfully, at least in simple cases, if the flow is rapid enough for gravity to be negligible and for viscosity effects to be confined to the boundary layer. In these cases, Euler's partial differential equations for non-

quasi-empirical approach has therefore been adopted. Finally, in Chapter 15, they have summarised many important limitations on the deductions made in Chapters 2 to 11 due to neglect of surface tension, dissolved gas and other physical variables. This discussion is almost entirely empirical.

The reviewer feels that the idea of bringing the three subjects together in a single volume is an admirable one. The book draws on the

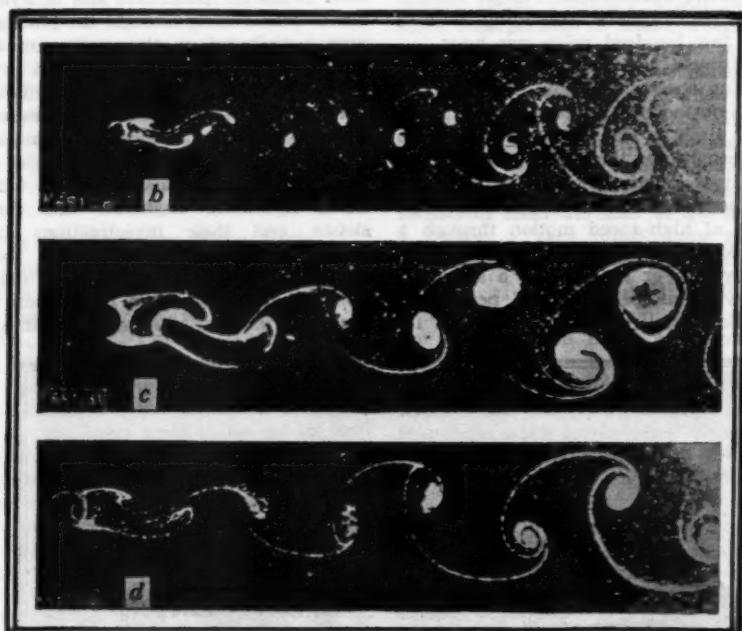


FIG. 2. Spreading of alternating vortices.

viscous flow are approximately applicable. However, the cases of wakes, or gas jets in a gas of nearly equal density and of liquid-jets in a liquid, cannot be treated even approximately in this way, in spite of the enormous mathematical literature suggesting the contrary. Presumably, the flow is determined by the Navier-Stokes equations, but the complexity of the observed experimental phenomena makes the difficulties of rational prediction apparent.

Recognising the situation thus briefly stated, the authors treat first the application of Euler's differential equations to flows with free boundaries. The major portion of the book (Chapters 2 to 11) is devoted to these applications. In the next three chapters (12 to 14) the authors turn their attention to the cases of laminar viscous, periodic and turbulent jets and wakes. Here exact results are exceedingly rare and a

resources of pure and applied mathematics, and of experimental physics, and it sheds light on numerous problems of hydraulics and aeronautics. Hence, as the authors remark in their preface, it would have the greatest interest for readers whose scientific curiosity spans all the fields just mentioned. However, others also would find it a useful and stimulating book to study in connection with their own problems.

The book is illustrated by numerous diagrams and excellent photographs of which we have taken the liberty of reproducing two. We make here due acknowledgement to the original sources quoted by the authors. We heartily commend the book to all those interested in or working at these fascinating fields of fluid dynamics.

C. V. R.

THE ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY *

THE appearance of the fifteenth volume completing this great work is an appropriate occasion for the publication in *Current Science* of an account of the features of the Encyclopaedia which make it a production of outstanding interest and importance, not only to industrial chemists and chemical engineers but also to the wider circle of scientific men working in Universities and research organisations.

The idea of publishing a comprehensive treatment of the American chemical industry originated with the management of Interscience Publishers. In 1944, Dr. R. E. Kirk and Dr. F. Othmer, both of the Polytechnic Institute of Brooklyn, were invited to act as editors-in-chief of such an undertaking. Planning and editorial work started on a small scale, but the editorial office staff soon grew to eight editors and necessary clerical personnel directed by Janet D. Scott and Anthony Standen. The first volume was published in 1947 and a production schedule of 6 to 7 months per volume was maintained thereafter. The fifteenth volume including a comprehensive index for the whole work appeared in December 1956. Over 1,000 authors co-operated in preparing the articles in the Encyclopaedia. Most of these authors are chemists or chemical engineers working in American industry, but some are scientists working in Universities and research institutions.

The phrase, "Chemical Technology", which defines the scope of the Encyclopaedia, has been taken extremely widely. It includes industrial chemistry, analytical methods and a wide range of general scientific subjects. The first 14 volumes, and some 300 pages of Volume 15, contain about 800 articles. Each of the authors is a specialist in his field, and each article was reviewed by one or more other specialists, thus ensuring an authoritative treatment. Each article concludes with a selected bibliography of the best references on the subject.

Approximately 400 of the 800 articles are on substances, or groups of substances. These include industrial products and natural substances. All important chemical articles of com-

merce are included. Chemicals of minor importance are not treated in articles under their own names, but are often described within more general articles. Emphasis is placed about equally on a scientific presentation of the physical and chemical properties of a substance and on its manufacture, which is often illustrated with flowsheets and diagrams of equipment. Production figures and prices are given, and also health and safety factors, where important, and analytical and testing methods, grades and specifications. Some 200 of the articles describe uses. Many of these are on groups of pharmaceuticals, on dyes classified by chemical groups, and on human uses. The unit operations and unit processes of chemical engineering are all described in separate articles, as also are fundamentals. Analytical methods are covered in a general article, and also individually. There are articles on general scientific subjects, and some of a completely general nature.

Six hundred and twenty pages in the fifteenth volume are devoted to an index arranged in alphabetical order covering the material contained in all the fifteen volumes. There are approximately fifty thousand entries. Any topic discussed in the Encyclopaedia may be found by its name entry. This unusually large and complete index is a most welcome feature which greatly enhances its utility to the seeker for information. The work itself appears in a standard and uniform format, each volume containing approximately 950 pages, 12" x 10". The work is printed on strong paper of high quality in beautifully clear type. The volumes are handsomely and strongly bound in black cloth, the volume numbers and contents being clearly indicated at the back of the volume, thus making it easy even without the index to locate the subject or subjects in which the reader is interested. The reviewer has read some of the articles on important subjects, both scientific and technical, of which he has special knowledge and found that they are both clear and comprehensive and that the material has been arranged in a well thought-out manner.

The publishers have announced that the set will be kept up-to-date by supplement volumes issued when necessary. The first supplement volume will be issued late in the year 1957.

C. V. R.

* *Encyclopedia of Chemical Technology* (Vol. 15), Waxes to Zymosterol (Interscience Publishers, Inc. 250, Fifth Avenue, New York-1), 1956. Pp. xiv + 936. Subscription Price \$ 25.00. Single Price \$ 30.00.

VIRUSES IN SEARCH OF DISEASE *

THE utilisation of newer tissue-culture techniques in virology has resulted in the discovery that man is the host of a multitude of viruses. During recent years the number of viral agents isolated is so many that it has become imperative to decide which of them are pathogenic and which are not. In this volume entitled 'Viruses in Search of Disease' is presented the Proceedings of a Conference of eminent virologists convened for the purpose. The subject-matter is dealt with under the heads: (i) Coxsackie viruses, (ii) new respiratory and ocular viruses, (iii) ECHO viruses, (iv) viral identification, and (v) criteria for aetiological association of prevalent viruses with prevalent diseases. The important conclusions are briefly summarized.

Coxsackie Viruses.—A study of this group of enteric viruses has been facilitated greatly by the use of suckling mice and the recognition that simple pathological criteria are adequate for the differentiation of Group A and Group B infections. Group A viruses induce flaccid paralysis and marked muscle degeneration, but no significant central nervous system lesions in suckling mice compared with Group B viruses which tend to cause encephalomyelitis, focal myositis and fat necrosis. On the basis of neutralization tests, Group A strains have been assigned to 19 antigenically distinct types and Group B strains to 5 types. Among these, only Type A 9 and all the five B strains produce cytopathogenic changes in tissue cultures. Hence, a great number of Coxsackie viruses are likely to be missed if the material is tested either in monkey-kidney or Hela tissue cultures and not in suckling mice.

Regarding their pathogenicity it would appear that there is a clinical distinction between the groups in humans. Broadly, Group A viruses are frequently associated with herpangina and Group B viruses with pleurodynia and aseptic meningitis.

Parrot has reported that Coxsackie Group A viruses, Types 2, 4, 5, 6, 8 and 10 are commonly associated with herpangina and that these same types are also associated with less well defined summer febrile disease that may be subclinical herpangina. Habel *et al.* found that in non-paralytic polio syndrome, apart from polioviruses Types 1 and 3, the viruses commonly

encountered were Coxsackie viruses Types A1 and A9. Melnick and Parrot also observed that Type A 9 virus was found frequently in cases of aseptic meningitis. Dalldorf has described a new Group A strain, not neutralized by antisera Types 1 to 19, which has been associated with relatively severe outbreaks of aseptic meningitis in various parts of Italy during the summer of 1955. This strain can be readily isolated in monkey-kidney tissue culture. According to Parrot it would appear that Types 1 and 7 and possibly 3 are still 'Viruses in Search of Disease'. There are very few data on the newer serotypes A 11 to A 19 in relation to disease.

There is good evidence incriminating Coxsackie B group of viruses as aetiological agents in Bornholm's disease and associated cases of aseptic meningitis. Infections with Types B1 and B2 viruses have been described in the United States and in the United Kingdom while in Sweden B3 strains have been isolated. Rhodes and Beale have described the isolation of 5 strains of Coxsackie B viruses (B2 and B4) from the cerebrospinal fluid of cases of aseptic meningitis. They consider that Coxsackie B viruses no longer fall within the category of 'Viruses in Search of Disease'. Enden has presented strong evidence to support the conclusion that Coxsackie B virus is responsible for certain cases of acute myocarditis in infants as well as for encephalomyelitis and meningitis which, on occasion, may be associated with cardiac disease.

Adenoviruses.—This group constitutes the new respiratory and ocular viruses, which share the same soluble complement-fixing antigens and have the common properties of ether resistance, apathogenicity for laboratory animals, and characteristic cytopathogenicity for human and simian epithelium. The group consists of at least 16 serotypes, of which 13 are isolated from human sources and 3 from simian sources. They are widely distributed and have been isolated from different parts of the world.

Jordan has described the frequency of adenoviruses in families. He found that antibodies to Types 1, 2 and 3 are common in adults and children while antibodies to Types 4, 5, 6 and 7 are less prevalent. Children had no antibody to Type 4 while antibodies to the higher types were rarely encountered. He considered that Types 1 to 7 were responsible for 1 to 5% of respiratory illnesses among the families. Rowntree *et al.* have reported that Types 1, 2 and 5 were associated repeatedly with acute febrile infections.

* *Viruses in Search of Disease*. Annals of the New York Academy of Sciences (Vol. 67) (Published by the Academy, New York), April 19, 1957. Pp. 209-446. Price \$ 6.00.

tions of the respiratory tract in infants. They, however, are of the opinion that further evidence is necessary to establish whether these viruses are really responsible for the illness. Type 3 adenovirus has been found to be the cause of epidemic outbreaks of pharyngoconjunctival fever, sporadic cases of catarrhal conjunctivitis, non-bacterial pharyngitis and acute undifferentiated respiratory disease in military recruits. Hilleman has shown that Types 4 and 7 account for the majority of respiratory illnesses among newly recruited soldiers while the infection is rare among seasoned soldiers. He has demonstrated that the administration of a vaccine containing both the types produced antibody response sufficient to protect against specific infection. It has been found by Rowe *et al.* that Types 6 and 10 appear to be aetiologically related to simple catarrhal conjunctivitis, while Type 8 is associated frequently with severe keratoconjunctivitis. No data are available regarding the other serotypes and their possible role in human disease.

Chanock has reported the high incidence of CA (croup associated) virus infections in infants with croup suggesting that this virus may be at least one of the aetiological agents of this clinical syndrome. The Sendai virus has also been shown to be responsible for acute respiratory disease in man.

ECHO Viruses.—The name stands for Enteric Cytopathogenic Human Orphan viruses. This group of viruses produce cytopathogenic effects in monkey-kidney tissue culture which are not neutralized by poliovirus antisera to Types 1, 2, 3, singly or combined and by Coxsackie antisera to Types B1 to B5 and A9. Further, they do not cause illness in suckling mice.

The evidence presented by Kibrick *et al.*, Meyer *et al.*, Karzon, Svedmyr, Rhodes and Beale and Habel *et al.* indicate that ECHO Type 6 virus is one of the causes of the syndrome described

as aseptic meningitis, which is clinically indistinguishable from non-paralytic poliomyelitis. Also, there is presumptive evidence that Types 2 and 7 may be associated with the condition.

Ramos-Alvarez has reported that ECHO viruses are significantly associated with summer diarrhoea in infants and children up to 4 years of age.

Werner has isolated a cytopathogenic transmissible agent from material collected from cases of erythema infectiosum. The exact relationship of this agent to the disease is not clear.

Viral Identification.—Melnick deals with the manner in which new virus isolates are handled and the problems associated with their identification. The biological and physical properties of the adenoviruses are discussed by Ginsberg while Ackermann deals with the mechanisms of persistent and masked infections in tissue culture. Hull and Minner describe several new viral agents from tissue cultures of kidney cells of apparently normal monkeys and emphasize the importance of these agents to investigators employing primary monkey-tissue cultures for their studies.

Criteria for Aetiological Association.—In an excellent article entitled 'The Virologist's Dilemma', Huebner draws attention to the various pitfalls in deciding the aetiological relationship of newly discovered viruses to disease and lays down the minimum criteria necessary for the purpose.

The papers presented at the Conference are of a highly technical nature and are definitely intended for the specialist in virology. A rather detailed summary has been given with a view to provide the general reader with a bird's eye view of the advances in the field. The volume which contains a fund of information, some of it unpublished, will be invaluable to all those interested in intestinal and respiratory viruses.

N. VEERARAGHAVAN.

RADIATION CONTROLS TITANIUM FURNACE

GAMMA RAYS from radioactive cobalt are being used to detect and control the level of molten titanium in a new titanium furnace. The titanium furnace in question is a major installation at the Westinghouse metals development plant of Westinghouse Research Laboratories at Blairsville, Pennsylvania, U.S. Successful operation of this new titanium furnace requires exact control of the molten surface of the titanium ingot inside it at a temperature of more than 3,000° F.

The gamma rays passing through the furnace are detected by means of two 'scintillation counters' and electrical pulses from the counter after amplification are fed to electronic circuits which drive a hydraulic system that raises or lowers the titanium ingot as desired.

The system is claimed to be highly reliable and is capable of maintaining the level of the titanium within one-hundredth of an inch of its ideal operating condition. This type of control can be used on other types of furnaces.

ULTRAVIOLET ABSORPTION SPECTRA OF MONOSUBSTITUTED BENZENES¹ A CORRELATION BY REACTIVITIES AND RESONANCE PARAMETERS

C. N. RAMACHANDRA RAO

R. B. Wetherill Laboratory of Chemistry, Purdue University, Lafayette, Indiana, U.S.A.

THE ultraviolet absorption spectra of benzene and its mono- and disubstituted derivatives may be represented as an approximately regular progression of at least three bands, namely, the secondary, first primary and second primary bands, in the order of decreasing wavelength. In early work, the ultraviolet spectra of substituted benzenes were always discussed in terms of the displacement of the secondary band. Doub and Vandenberg² showed that the first primary band (also known as the B-band) is capable of displacement to the edge of the visible region and that it provides a basis for a more logical interpretation of benzenoid absorption.

The displacing effect of a substituent on the primary band of benzene ($\Delta\lambda = \lambda - 203.5$, where λ is the wavelength corresponding to the first primary absorption maximum of the substituted benzene in m⁴) has been considered to an extent, a measure of its electron donating or withdrawing power. In this communication, a correlation of the ultraviolet absorption spectra of monosubstituted benzenes with the electrical properties of the substituents has been presented. Hammett's σ values³ and Brown's σ^+ values^{4,5} have been made use of as substituent constants for purposes of correlation. In general, the substituent constant, σ , is considered to be the measure of the ability of the substituent to change the electron density at the reaction centre. While a negative value of the substituent indicates an increase in the electron density, a positive value indicates a decrease. Greater the effect of the substituent on the electron density, larger is the numerical value of σ . The σ^+ values are the substituent constants developed by Brown and Okamoto^{4,5} suitable for electrophilic reactions. Since electrophilic reactions provide far greater opportunity for resonance contributions by the substituent, the difference between σ and σ^+ values is attributed to such resonance.

When the $\Delta\lambda$ values of monosubstituted benzenes were plotted against either para- σ or para- σ^+ values, an approximately linear relationship was found. This relationship can be expressed as:

$$\Delta\lambda = \rho \sigma \quad (1)$$

where ρ is the slope of the line. ρ is a measure of the sensitivity of the equilibrium or

the transition to change in the electron density. Since $\Delta\lambda$ for benzene itself is zero, one gets two straight line plots with different slopes, one for the electron withdrawing groups (positive σ values) and another for the electron donating groups (negative σ values). Accordingly, ρ is positive or negative depending on the sign of the σ values.

The wavelength changes in the primary bands of benzene appear to be caused by resonance and steric interactions rather than coulombic interactions. In monosubstituted or para-disubstituted benzenes, the steric effects can be assumed to be negligible and consequently the resonance interactions will be mainly responsible for the observed changes. Recently, Taft⁶ has proposed a quantitative separation of the Hammett σ value to independent inductive and resonance contributions according to the equation:

$$\sigma = \sigma_i + \sigma_r \quad (1)$$

σ_i is the inductive component and σ_r , the resonance component, can be considered to be a measure of the free energy effect resulting from the ability of the substituent to repel or attract electrons through resonance interaction with the π -orbital of the benzene system. A plot of the $\Delta\lambda$ of monosubstituted benzenes against the para-resonance parameters of the substituents ($\text{para-}\sigma_r = \sigma_{para} - \sigma_i$) is found to be reasonably linear (cf. Fig. 1). A similar rela-

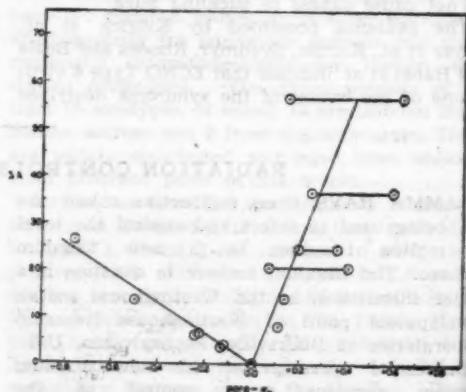


FIG. 1. Correlation of the displacement of the primary band of benzene with resonance parameters of substituents.

No. 9
Sept. 1957]

tionship is also observed when one employs $\text{para-}\sigma_{\text{R}}^+$ ($\text{para-}\sigma_{\text{R}}^+ = \sigma^+_{\text{para}} - \sigma_{\text{R}}$). No straightforward relationship of $\Delta\lambda$ with inductive parameters was apparent. In general, the linear plots follow the equation:

$$\Delta\lambda = \sigma_{\text{R}}\rho_{\text{R}} \quad (3)$$

The values of ρ_{R} are about 130 and -32 for the electron withdrawing ($+\sigma_{\text{R}}$) and electron contributing ($-\sigma_{\text{R}}$) substituents, respectively. When σ_{R}^+ values are used for the correlation, the slope is about -17 for the electron donating groups. In all these correlations it has been tacitly assumed that hydrogen acts like a substituent possessing the same value of the substituent constant (0.00) or the resonance parameter (0.00) and the $\Delta\lambda$ value (zero) when opposed to either *ortho*-*para* or *meta*-orienting groups. However this assumption follows from the definition of σ or σ_{R} and $\Delta\lambda$, since all these quantities are relative to hydrogen as standard. Doub and Vandenbelt² have made a similar observation and have in fact assigned a displacing effect to this hypothetical chromophore. In Fig. 1 for the groups CN, NO₂, COCH₃ and COOC₂H₅, Hammett σ_{R} values are shown for a lower limit and the "dual" σ_{R} values for an upper limit. It is clear that a value in between these two limits would reasonably correlate the $\Delta\lambda$ values for the CN, NO₂ and COCH₃ groups. The extrapolated values of σ_{R} for these three groups are about 0.16, 0.29 and 0.44 respectively. A similar observation has been made by Taft⁷ in correlating the nuclear magnetic shielding parameters, δ' , for *meta*- and *para*-substituted fluorobenzenes by inductive and resonance parameters. It may be apt to mention at this juncture that while the inductive effect should essentially be independent of the reaction, the resonance contribution would be expected to vary with the electronic demands of the reaction. It is interesting to note that for monosubstituted benzenes, larger the numerical value of the resonance parameter of the substituent, greater is the magnitude of the displacement of the primary band.

Doub and Vandenbelt² reported a linear relationship between their derived displacement values ($\delta\lambda_0$) and the differential polarizabilities of Price⁸ ($\Delta\sigma = \sigma_{\text{para}} - \sigma_{\text{meta}}$). $\Delta\sigma$ is actually a measure of the resonance contribution of a substituent in view of the fact that the *meta*- σ values in many cases are nearly equal to the inductive parameters. This is in variance with

Price's view, that $\Delta\sigma$ depends primarily on electrostatic effects. It is found that a plot of $\delta\lambda_0$ versus $\text{para-}\sigma_{\text{R}}$ exhibits a relationship very similar to that of $\Delta\lambda$ discussed above.

The correlations presented above clearly point out that the wavelength shifts caused by the substituents on benzene are a measure of resonance effects, that is, of effects associated with the directional displacement of electrons to or from the ring depending on the electron withdrawing or contributing nature of the group. Recent work,⁹ after the publication of Rao's correlation¹⁰ of the ultraviolet absorption spectra of disubstituted benzenes with reactivities, has shown that it is essential to consider the resonance parameters in the case of disubstituted benzenes also. A detailed report on the correlations of the ultraviolet absorption spectra of disubstituted benzenes with reactivities and resonance parameters and their applicability to studies of mechanisms of reactions and to estimations of electrical properties of groups will be published in the near future. Preliminary investigations¹¹ have shown that the dipole moments of substituted benzenes show similar relationships with substituent constants. As can be expected, in the correlation of the dipole moments, the overall electronegativities of the substituents (combination of resonance and inductive parameters) seem to be more applicable.

The author is indebted to Miss Gladys Blanche Silverman for her assistance in the preparation of the manuscript.

1. "Ultraviolet absorption spectra of benzene derivatives," Part I.
2. Doub, L. and Vandenbelt, J. M., *J. Am. Chem. Soc.*, 1947, **69**, 2714.
3. Jaffe, H. H., *Chem. Rev.*, 1953, **53**, 191.
4. Brown, H. C. and Okamoto, Y., *J. Am. Chem. Soc.*, 1957, **79**, 1913.
5. Okamoto, Y. and Brown, H. C., *J. Org. Chem.*, 1957, **22**, 485.
6. Taft, R. W., in *Steric Effects in Organic Chemistry*, edited by M. S. Newman, John Wiley and Sons, Inc., New York, 1956, Chapter 13.
7. —, *J. Am. Chem. Soc.*, 1957, **79**, 1045.
8. Price, C. C., *Mechanisms of Reactions at Carbon-Carbon Double Bonds*, Interscience Publishers, Inc., New York, 1946.
9. Rao, C. N. R., *Chemistry and Industry* (in press).
10. —, *Ibid.*, 1956, 666.
11. —, Wahl, W. H. and Williams, E. J., *Canadian J. Chem.* (in press).

PRELIMINARY OBSERVATIONS ON THE PHARMACOLOGICAL ACTIONS OF VARIOUS FRACTIONS OF *NARDOSTACHYS JATAMANSI*—DC.

B. C. BOSE, S. S. GUPTA, R. VIJAYVARGIYA, A. Q. SAIFI AND J. N. BHATNAGAR

Dept. of Pharmacology, M. G. M. Medical College, Indore

NARDOSTACHYS JATAMANSI is being used in indigenous medicine for the treatment of epilepsy, chorea, hysteria, palpitation, flatulence, colic pains and headache for a very long time. In recent years, the plant has drawn the attention of several workers and clinical and experimental work has been carried out on its neurocirculatory,⁷ anti-fibrillatory,¹ hypotensive⁶ and diuretic effects.⁵ In view of the above observations, it was considered advisable to carry out a series of chemical and pharmacodynamic studies of the plant, from this laboratory.

From the phyto-chemical studies, it was observed that the rhizome and the root contained 2% of essential oil; 3.5% of resins and 0.016% of alkaloids as reported in a separate communication.³

For the isolation of various active principles, powdered rhizomes and roots were extracted with different solvents. Fraction A represented the aqueous extract and fraction B the alcoholic extract. The volatile oil was collected by steam distillation, dissolved in propylene glycol (1:2) and named as fraction C. The alkaloids were extracted with alcohol, concentrated and purified after removal of the resins and colouring matters by acid precipitation and passage through columns of cation and anion exchange resins. This fraction was named as fraction D, and adjusted to contain 2 mg./c.c. of the alkaloids.

Pharmacodynamic effects were studied on the cardiovascular system of a series of 20 normotensive mongrel dogs weighing between 6 to 8 kg. The hypotensive effect was also evaluated in acute experimental hypertension produced by slow perfusion of nor-adrenaline in 10^{-4} concentration through a Phipps-Birds slow micro-infusion pump capable of delivering 1 c.c. of the solution in 70 minutes. The cardiac effect was studied by recording myocardial contraction on dogs and also on isolated frog heart. Actions of the various fractions were studied by standard techniques on isolated intestine, uterus and bronchial rings of guinea-pigs and frog rectus muscle. The sedative effect of the alkaloidal fraction was investigated in pigeons and rats.

Of all the four fractions, fraction D containing the total alkaloids produced a fall in B.P.

TABLE I
Showing hypotensive effect of different fractions of *N. jatamansi* on the carotid pressure of anaesthetised dogs. Doses for fractions A and B refer to g. equivalent of crude drug per kg., whereas that for fraction C, to the quantity of the volatile oil. Doses for fraction D, refer to 1/250 part of the doses indicated in the first column

Dose g/kg.	Average % fall in B.P. with different fractions			
	'A'	'B'	'C'	'D'
0.05	4.1	5.8	4.5	9.1
0.1	5.8	9.1	8.3	18.2
0.2	11.3	12.5	9.3	37.9
0.4	12.2	18.2	12.3	54.5

to the extent of 54.5% in a dose of 1.6 mg./kg. On further analysis of the table, it is evident that a fall in B.P. to the extent of 18.2% was producible by 0.4 g. of the alcoholic extract, as against 0.4 mg. of the total alkaloids. It is therefore likely that the hypotensive effect of the alcoholic extract may be due to the presence of alkaloidal substances contained in it.

An examination of the hypotensive effect produced by the total alkaloids of *N. jatamansi*, revealed that the fall in B.P. was of a prolonged nature and fairly comparable to serpentine and to an extent reserpine also, as is shown in Fig. 1.

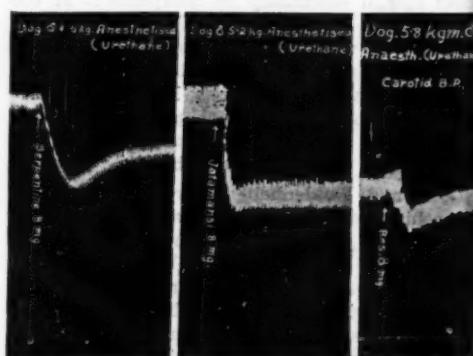


FIG. 1. Showing the hypotensive effect of *N. jatamansi*, serpentine and reserpine in equivalent doses.

Besides its hypotensive action, the alkaloidal fraction also showed a mild degree of negative chronotropism in dog's heart *in situ*. On electrocardiographic studies in asphyxiated dogs with inverted T and prominent P waves, the total alkaloid in 1-2 mg./kg. doses, caused an appreciable degree of bradycardia, depression of R wave and reversion of the inverted T waves in 5-10 minutes. This effect could be due to improvement of the coronary circulation. In isolated frog heart perfusion of 0.1 c.c. of the total alkaloid at a rate of 0.25 c.c. per minute, also caused a significant diminution in the amplitude of cardiac contraction.

The pharmacodynamic effects of the alkaloidal fraction on isolated organs are shown in Fig. 2.

bronchoconstriction was also partially relieved by the drug.

The alkaloidal fraction was also found to produce a mild degree of sedative effect, characterised by drowsiness and somnolence in 1-2 mg. 1 V. dose in rats and with 3-6 mg. 1 V. doses in pigeons. The sedative effect was produced within a period of 5-10 minutes in the former case and in 15-20 minutes in the latter. The 'pecking reflex' was absent and the animals were disinclined to take any food in spite of the fact that the same was withdrawn 4-5 hours before the drug was given.

From the present investigation it is evident that *N. jatamansi* is endowed with a significant and sustained hypotensive action which is further enhanced in experimental hypertension.

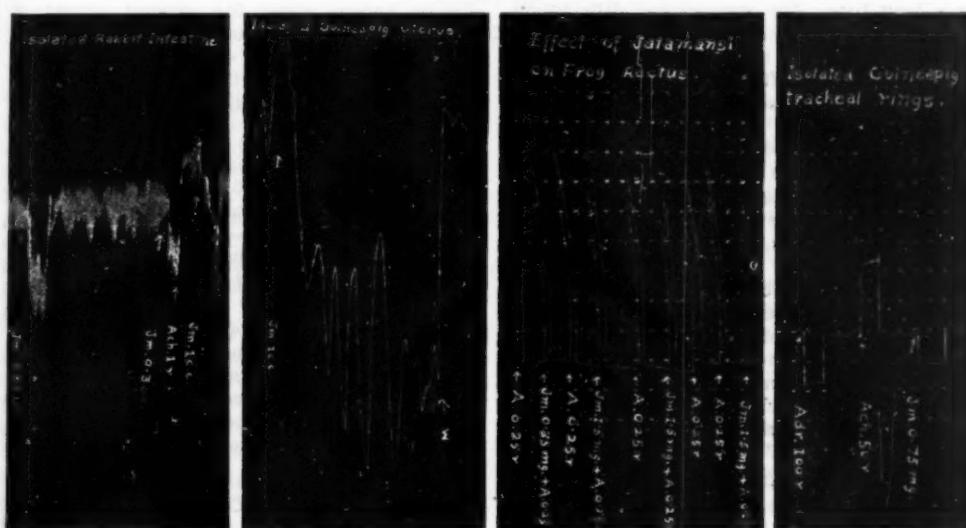


FIG. 2. Showing the muscle relaxant effect of the total alkaloids of *N. jatamansi*.

From the above figure it will be observed that relaxation of tone, with inhibition of peristalsis, is observed with 0.2×10^{-3} concentration of the alkaloids in tyrode bath. Spasmolytic effect was found to be more marked in spasmically contracted intestine after administration of barium chloride, acetylcholine and posterior pituitary extract. Guinea-pig uterus was relaxed with cessation of rhythmic movement in 0.1 mg./c.c. concentration of the alkaloid. Acetylcholine induced contraction in frog rectus muscle was inhibited in 0.25 mg./c.c. concentration. Similarly, bronchial chain was relaxed in 10^{-5} concentration on lines comparable to adrenaline. Histamine induced

The hypotensive action is not affected by previous atropinisation.

The drug also produced marked relaxation of plain muscles and depression of the central nervous system. The total alkaloid produced a mild degree of relaxation of skeletal muscle as evidenced by the inhibition of acetylcholine action on the frog rectus muscle.

The above observations, on the various actions of *N. jatamansi*, indicate similarity of the new drug with Rauwolfia alkaloids and it may be interesting to elucidate its exact mechanism and site of action with a view to assess its efficiency in the therapy of hypertensive conditions.

The authors are thankful to Dr. G. C. Sepaha for his kind assistance in the electrocardiographic studies.

1. Arora, R. B. and Madan, B. R., *Ind. Jr. Med. Res.*, 1956, **44**, 99.
2. Bose, B. C., Gupta, S. S., Bhatnagar, J. N., Vijayvargiya, R., *Ind. Jr. Med. Sci.* (under publication).

3. Bose, B. C., Vijayvargiya, R. and Bhatnagar, J. N., *Ind. Jr. Med. Sci.* (under publication).
4. Chopra, R. N., Bose, B. C., Gupta, J. C. and Chopra, I. C., *Ind. Jr. Med. Res.*, April 1942, **30**, 2.
5. Gujral, M. L., Saxena, P. V., Misra, S. S., *Jr. Ind. Med. Ass.*, 1955, **25**, 49-51.
6. Sheth, U. K. and Kekre, M. S., *Ind. Jr. Med. Sci.*, 1956, **10** (1), 32.
7. Vakil, R. J. and Dalal, S. C., *Ind. Practitioner*, 1955, **8**, 277-80.

THE ORIGIN OF THE AURORA

WITH Aurora, as with much else, there is a big difference between ability to explain up to a certain point and the solving of the further problems which then are encountered. Many of the main facts have been known for a long time. The symmetrical distribution of aurora about the magnetic axis of the earth's magnetic field, the fact that great magnetic storms and aurora often both follow an eruption or flare on the sun after an interval of a day has two further implications. Not only is a connexion shown with the sun, it follows that the means by which the sun's effect is produced must be such as to be consistent with a time interval of this order. It cannot be by any form of radiation, for the effect would then be simultaneous with the visual flare. The immediate cause must be some form of material emission from the sun, and the arrival of this in the earth's atmosphere. Further, since electrically charged particles are deflected by a magnetic field, whereas neutral particles are not, it can be concluded that the relevant part of the material emission consists of electrically charged particles.

HYDROGEN MOVEMENT

There are then three main questions: What are the particles? In what ways do they approach the earth? And what are the effects that they produce in the earth's atmosphere? The most definite evidence on the first of these questions is comparatively recent. During a great auroral display in August 1950, A. B. Meinel, at Yerkes, in the U.S. recorded two spectra which provided evidence, not merely of the presence of hydrogen in auroral regions, but also of its movement at high speed through the upper atmosphere. The spectra showed displacements in the wavelengths of a line characteristic of hydrogen, such as are found whenever a light source, such as a star, is in movement towards or away from the observer.

From a comparison between two spectra, obtained with the spectrograph pointing in differ-

ent directions, Meinel inferred that the hydrogen atoms which he had observed had been travelling at some 2,000 miles a second in the direction of the lines of force of the earth's magnetic field. In conjunction with what was already known about the general connexion between aurora and terrestrial magnetism, this was reasonably direct evidence that proton, otherwise hydrogen nuclei, were contained in the particle stream from the sun.

The second question is about the approach of these particles to the earth. As early as 1897, Prof. Birkeland, in Oslo, attempted to reproduce aurora in a laboratory experiment. He placed a small sphere—uniformly magnetized to represent the earth in an evacuated vessel, and directed a stream of cathode rays, or electrons, towards it. Under suitable conditions, he found that the tracks of the particles fell on the two well defined zones round the magnetic poles. With necessary variations, the same experiment could have been performed also with protons—and would then have agreed with Meinel's much later observations.

This experiment was the beginning of a life-long interest by Prof. Carl Stormer. His first interest was mathematical; but he also did more for the observation of aurora than any one else before or since. A glow on the horizon rises to become an arc that may then remain quiet for several hours until its lower border suddenly brightens, and bundles of rays form here and there along its length. The arc then loses its regular shape and develops folds, so that it resembles a gigantic curtain waving in the sky. When rays extend beyond the zenith, they appear to converge to a point, and so take the form of a crown, or corona if they come from all directions round the radiation point, or of a fan if their directions lie within a limited range. The display usually ends with 'flaming' successive waves of light surge upwards from the horizon to the zenith.

AT
A
Co., L
rators
Establish
pons P
to be
uranium
emergenc
The
compa
that ac
tive h
earth
then f
electro
leaves
tion w
uncha

In t
back
comm
thus a
be ach
tive i
tandem
stage
lation.

Con
olved
genera
a pre
meter.

MAGNETIC CHANGES

Stormer, with his mathematics, was able to give a qualitative explanation of these different forms assumed by aurora. But the problem of the approach of a charged particle to the earth is a simple one only if it is assumed that there is just one particle in question at a time. The simple theory is therefore inadequate, and a number of subsequent attempts have been made to improve on it—each based on a different approach. Many specialized problems remain for solution.

There is need to examine the correspondence between aurora borealis and aurora australis and the relation between the pattern of the magnetic field changes and the accompanying auroral forms; also, estimates of the depth as

well as the extent of auroral features like arcs and rays are required. It is for such reasons that aurora is now being continuously photographed, for example, in an Antarctica, using an "all sky camera" designed by the Geophysical Institute of Alaska.

The third question—about the changes produced in the earth's atmosphere—is one more difficult to present shortly. It may be enough, therefore, to recall that conditions in the upper atmosphere are important in connexion with radio propagation, among other reasons, and that the study of aurora is one of a number of new multiplying methods by which the state and composition of the upper atmosphere can be studied.

A NEW TYPE PARTICLE ACCELERATOR

AT the request of the U.K. Atomic Energy Authority, Metropolitan Vickers Electrical Co., Ltd. are to collaborate with the Authority in the design of two tandem electrostatic generators for use at the Atomic Energy Research Establishment, Harwell, and the Atomic Weapons Establishment, Aldermaston. This new type of particle accelerator is to enable research work to be carried out on the nuclear properties of uranium and similar elements and to produce energetic neutrons for other nuclear work.

The novel feature of the tandem generator compared with the Vande Graff accelerator is that acceleration is achieved in two stages. Negative hydrogen ions are first accelerated from earth potential to an energy of 6 MeV. and are then fired into a stripper. This removes the electron from the outer shells of the atom and leaves the ions still moving in a forward direction with a net positive charge but with almost unchanged energy.

In the second stage, positive ions are brought back to earth potential, so that total energy communicated to the ions is 12 MeV. Ions are thus accelerated to twice an energy which could be achieved in a single stage. Generally, negative ions are more difficult to form than positive ions; therefore, the beam current in a tandem machine is smaller than in a single stage machine. But there is a saving in insulation.

Considerable engineering problems are involved in designing and constructing a tandem generator. The generator will be housed inside a pressure vessel 45 ft. high and 9 ft. in diameter. An insulating belt, mounted on pulleys

16 ft. apart, will move at 3,000 ft./min. and electric charge sprayed on lower end will be carried to a central terminal where the charge is collected. The charge will leak back to earth through two potential divider chains. The accelerator is to be housed inside a 'stack' of equipotential plates and will pass through the ends of the pressure vessel.

Operation of a high voltage electrostatic generator necessitates 'pressurising' the vessel containing the accelerating electrodes. In this design, the gas pressure will be 250 lb./sq. in. with a total weight of two tons of gas. Much of the cost of this type of equipment is associated with equipment for transferring the gas from reservoirs to the pressure vessel and keeping it dry and free of atmosphere contamination. A very high vacuum will be required throughout the ion path and to control the accelerating and deflecting fields. These fields, together with focussing, will be controlled by electronic stabilisers to an accuracy of a few parts in 100,000.

The higher available energies will permit the study of nuclear reactions produced by bombardment of uranium and the transuranic elements and should advance considerably knowledge of nuclear properties of these elements.

It will be possible to produce neutrons of controllable energy in the range up to 30 MeV., and also to study their interaction with other nuclei. Other possibilities include the acceleration of heavier ions such as oxygen and fluorine. The tandem generator would thus extend the range of studies that can be carried out with electrostatic generators.

LETTERS TO THE EDITOR

PAGE	PAGE		
<i>Fluorescence Spectra of Aqueous Solutions of Uranyl Nitrate at Room Temperature</i> —D. D. PANT AND D. P. KHANDELWAL	282	<i>Riccia crozalsii</i> Levier and <i>Riccia warnstorffii</i> Limpr. from India—RAM UDAR	287
<i>Effect of Soyabean Inhibitor and Vitamin B₁₂ on Growth of Rice Moth Larva (Coryca cephalonica St.)</i> —R. SIVARAMAKRISHNAN AND P. S. SARMA	283	<i>Haploid Chromosome Numbers in the Testis of the Termite King Odontotermes redemanni (Wasmann)</i> —BARUN-DEB BANERJEE	288
<i>Change in the Mineral Composition of Aspergillus niger during Biosynthesis of Citric Acid</i> —P. N. RAINA AND C. V. RAMAKRISHNAN	285	<i>Cercospora Leaf-Spot of Rauwolfia serpentina Benth.</i> —N. N. MOHANTY AND S. K. ADDY	289
<i>The Free α-Amino Acid Nitrogen Content of the Skeletal Muscle of Some Marine Fishes and Invertebrates</i> —N. K. VELANKAR AND T. K. GOVINDAN	285	<i>An Eriophyid Mite Injurious to Sugarcane</i> —M. PUTTARUDRIAH AND S. USMAN	290
<i>Modifications in the Colorimetric Estimations of Mn and Mo</i> —K. L. MUKHERJEE	286	<i>Differentiation within the Tetraploid Race of Sisymbrium irio Complex</i> —T. N. KHOSHOO	290
		<i>Cause for the Failure of Seed-Setting in the Cross Corchorus olitorius \times C. capsularis</i> —A. T. GANESAN, S. S. SHAH AND M. S. SWAMINATHAN	292

**FLUORESCENCE SPECTRA OF
AQUEOUS SOLUTIONS OF URANYL
NITRATE AT ROOM TEMPERATURE**

PRINGSHEIM¹ has summarised the situation regarding the fluorescence spectra of aqueous solutions of uranyl salts arising out of the work, notably, of Nichols and Howes,² and Levshin.³ A great variety of spectra of these solutions, observed in the frozen state (where the intensity is considerably larger than at room temperature), is supposed to originate from a correspondingly great variety of complexes formed in the solution. However, no specific attempt has been made so far to investigate how exactly the fluorescence spectra are influenced by specific processes of complex formation. The uranyl nitrate solution is particularly suited for this study on account of its greater solubility in water, and its ability to form anionic complexes as well as to undergo hydrolysis. Further, since the kinetics of chemical reactions is more intimately known in the liquid state than in the frozen state, a

study of fluorescence spectra at room temperature should prove more suitable as a first step for understanding the complexity of the frozen state spectra.

While the spectrum of the uranyl nitrate solution in the frozen state showed the most complex behaviour, it is reported that at room temperature it consisted of a few diffuse bands, and that when the concentration was decreased to less than 0.5 molar it showed a completely different character and was quite continuous. More dilute solutions were not examined, presumably due to very low intensity. In the present investigation the spectra have been scanned at room temperature (10° C.) with a photomultiplier tube and a monochromator, using Hg 3650 Å.U. group of radiations for excitation. Aqueous solutions of dilution from 1.0 to 0.015 M (pH ranging from 1.0 to 3.6) were used. The results are presented in Fig. 1 A. In Fig. 1 B are shown the fluorescence spectra as obtained by adding various quantities of concentrated HNO₃ to the solution, keeping the

U-conc. fixed at .085 M, and in Fig. 1C are shown the spectra obtained for a similar solution with different amounts of NaOH added to it.

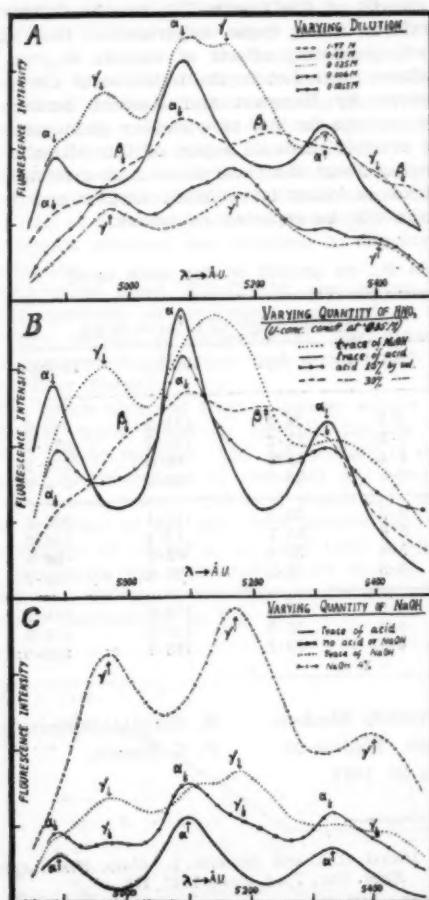


FIG. 1

The bands marked α correspond to those given by the solid, and are the bands reported by earlier workers. The bands marked β (Fig. 1A) appear only in very concentrated solutions, and have not been reported earlier. They diminish in intensity rapidly on dilution, and are absent in our curve for .49 M solution (intermediate stages not shown in the figure). These bands regain in intensity on addition of NO_3^- , even in dilute solutions (Fig. 1B). Their appearance is therefore connected with greater molal concentration of NO_3^- , and

they thus appear to be due to an anionic complex. The disappearance of these bands even on small dilution is apparently associated with the fact that the nitrate solutions behave as strong electrolytes.⁴ On further dilution, another new series of bands, marked γ , appears. These bands are towards the violet of the β bands, and are quite intense. They gain in strength with dilution (Fig. 1A) or on addition of NaOH (Fig. 1C), so that ultimately only the γ bands are present in the spectrum. With the addition of very small amounts of acid the γ bands disappear, and the α bands appear again (Fig. 1B). This goes to show conclusively that the appearance of γ bands is linked with the hydrolysis of the uranyl ion.

We have also investigated the spectra of solutions, similar to those mentioned above, at low temperatures, and it appears possible to understand the variations in their nature on lines similar to the above (details to be published elsewhere).

Dept. of Physics, D. D. PANT.
D.S.B. Govt. College, D. P. KHANDELWAL.
Naini Tal, August 1, 1957.

1. Pringsheim, P., *Fluorescence and Phosphorescence* (Interscience), 1949.
2. Nichols, E. L. and Howes, H. L., *Fluorescence of Uranyl salts*, Carnegie Inst., Washington, 1919.
3. Levshin, V. L., *Acta Physico Chimica, U.R.S.S.*, 1937, **56**, 661.
4. Dittrich, C., *Z. Physikal. Chem.*, 1899, **29**, 449; Robinson, R. A., Wilson, J. W. and Ayling, H. S., *J. Am. Chem. Soc.*, 1942, **64**, 1479.

EFFECT OF SOYABEAN INHIBITOR AND VITAMIN B₁₂ ON GROWTH OF RICE MOTH LARVA (*CORCYRA CEPHALONICA* ST.)

THE inability of certain insect pests to develop normally on soyabean products was first reported by Mickel and Standish.¹ Earlier, Ham and Sandstedt² observed that the soluble fractions of raw soyabean were able to inhibit trypsin and that a concentrate of these induced a retardation of growth of chicks fed on an otherwise normal diet. Further evidence of the growth inhibitory nature of the antitrypsins in the raw soyabean was obtained by Klose *et al.*³ working with rats, and by Almquist and Merritt⁴ with chicks. Recently, Baliga and Rajagopalan^{5,6} have found that the growth retardation of rats induced by the presence of the raw soyabean meal extract could be counteracted by Vitamin B₁₂. In view of the great resemblance of the rice moth larva to the rat in its require-

ments for vitamins of the B group, an attempt has been made in the present study to determine whether vitamin B_{12} has any such role in the nutrition of the insect, *Coryza cephalonica* St. (rice moth larva).

The soyabean inhibitor extract was prepared by the method of Borchers *et al.*⁷ and its activity was determined according to the method of Anson⁸ using casein as the substrate, the activity being expressed as Trypsin Inhibitor Units (T.I.U.) per ml. of the extract. Heat treatment of the inhibitor was carried out by autoclaving the extract for 30 min. at 15 lb. pressure per square inch.

TABLE I
Effect of Crude Soyabean Inhibitor and vitamin B_{12} on growth of rice moth larva

Batch	Supplements per 5 gm. of basal diet	Average weight of 10 larvae in mg.			
		Initial	5 days	10 days	15 days
A	Control	..	7.3	28.4	121.2
	0.05γ Vitamin B_{12}	..	7.2	21.2	105.2
	Raw Inhibitor $\equiv 8000 \times 10^{-6}$ T.I.U.	..	6.4	18.8	68.8
	do. + 0.05γ B_{12}	..	7.3	25.5	106.8
B	Control	..	5.5	33.0	111.4
	0.05γ Vitamin B_{12}	..	5.9	35.2	92.8
	Raw Inhibitor $\equiv 12,000 \times 10^{-6}$ T.I.U.	..	5.4	30.4	63.0
	do. + 0.05γ B_{12}	..	5.8	32.4	125.2
C	Control	..	4.9	37.5	118.6
	Autoclaved Inhibitor $\equiv 12,000 \times 10^{-6}$ T.I.U.	..	4.9	33.3	120.9
	do. + 0.05γ B_{12}	..	4.8	36.1	115.7

T.I.U.—Trypsin Inhibitor Units.

The basal diets used in the experiments described here essentially consisted of casein 10 parts, dextrose 90 parts, dried brewer's yeast 5 parts, cholesterol 1 part and Philip and Hart Salts IV mixture 2 parts. The experimental diets were prepared by supplementing the appropriate amounts of the raw and autoclaved inhibitor extract and vitamin B_{12} as indicated.

The technique for the study of the nutrition of rice moth larva has been described earlier.⁹ Rice moth larvae, 10-12 days old on whole wheat flour, were picked and allowed to develop on the appropriate experimental diets for about three weeks. Periodically ten larvae were selected at random and weighed to follow their growth. The results are presented in Table I (vide table appended).

From the data it can be clearly seen that the soluble fractions of raw soyabean induce a retardation of growth and that the addition of vitamin B_{12} exerts a beneficial effect on the growth response of insects fed with the inhibitor concentrate. Further, it is evident that

autoclaving the crude trypsin inhibitor extract completely destroys the toxic materials present in it. The addition of vitamin B_{12} alone to the basal diet produced no positive increase in growth of the insects. It can be inferred, therefore, from these experiments that the growth-promoting effects of vitamin B_{12} on a soyabean meal diet in the nutrition of *Coryza* observed by Bhagwat and Kamala Sohoni¹⁰ may perhaps be due to a similar phenomenon. The possible mode of action of this vitamin in bringing about the reversal of such growth inhibition is being investigated further and full details will be reported elsewhere.

University Biochem.
Lab., Madras-25,
July 28, 1957.

R. SIVARAMAKRISHNAN.
P. S. SARMA.

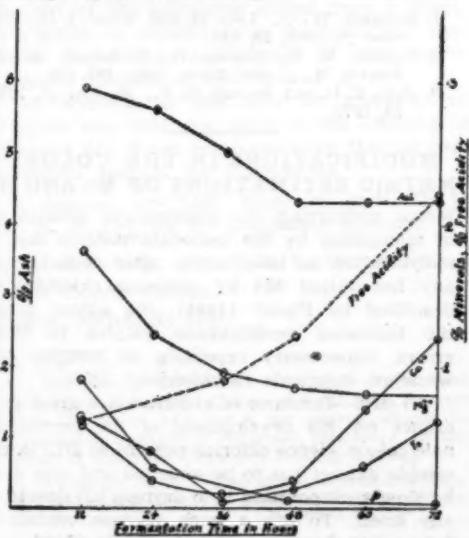
1. Mickel, C. E. and Standish, J., *Univ. Minn. Agri. Expt. Sta. Tech. Bull.*, 1947, 178.
2. Ham, W. E. and Sandstedt, R. M., *J. Biol. Chem.*, 1945, 161, 635.
3. Klose, A. A., Hill, B. and Fevold, H. L., *Proc. Soc. Expt. Biol. Med.*, 1946, 62, 10.
4. Almquist, H. J. and Merritt, J. B., *Ibid.*, 1953, 83, 269.
5. Baliga, B. R., Balakrishnan, S. and Rajagopalan, R., *Nature*, 1954, 174, 35.
6. Baliga, B. R. and Rajagopalan, R., *Curr. Sci.*, 1954, 23, 51.
7. Borchers, R., Ackerson, C. W. and Sandstedt, R. M., *Arch. Biochem.*, 1947, 12, 367.
8. Anson, M. L., *J. Gen. Physiol.*, 1938-39, 22, 79.
9. Sarma, P. S., *Ind. J. Med. Res.*, 1943, 31, 165.
10. Bhagwat, R. V. and Kamala Sohoni, *Curr. Sci.*, 1955, 24, 303.

CHANGE IN THE MINERAL COMPOSITION OF *ASPERGILLUS NIGER* DURING BIOSYNTHESIS OF CITRIC ACID

DURING the investigations on the biosynthesis of citric acid in *Aspergillus niger* grown in MYG medium, a change in the ash content of the mat was observed during the peak period of citric acid production thus showing that minerals may play a role in the biosynthesis of citric acid in *Aspergillus niger*. A preliminary investigation was carried out to analyse the mat for ash and minerals like calcium, magnesium and iron at different stages of fermentation and the results obtained are recorded in this communication.

Aspergillus niger, N.R.C. 233, was grown in MYG medium as reported previously.¹ At different periods of fermentation, the growth was removed by filtration and pressed dry in a buchner funnel.

The solids obtained from a known weight of the mat were ashed in electric furnace at 500°C. for 45 minutes. The ash content is expressed as percentage of the total dry weight of the sample taken. Calcium, magnesium and iron contents of the ash were determined by the method of Cheng *et al.*² and total inorganic phosphate was estimated by the method of Fiske and Subba Row.³ The results are graphically represented in Fig. 1.



Change in Mineral Content and Free Acidity during the growth of *A. niger* in MYG Medium.

* MYG—Malt extract, Yeast extract, Glucose medium.

Fig. 1 shows that magnesium and phosphorus contents decrease whereas iron and calcium contents increase during the peak production of citric acid. Since Ramakrishnan and Martin⁴ have found that magnesium inhibits the condensing enzyme of *A. niger*, it may also be possible that iron, calcium and phosphorus influence the activities of the enzymes involved in citric acid formation. Further studies on the effect of these minerals at different concentrations on the activity of isolated enzyme systems will show whether the change in mineral contents of the mat during citric acid production has got any significance on the biosynthesis of citric acid in *A. niger*.

Our thanks are due to Miss Mary Clements, Division of Applied Biology, National Research Council of Canada, Ottawa, for the gift of citric acid producing strain, *A. niger*, NRC 233.

Biochemistry Dept., P. N. RAINA.
Faculty of Science, C. V. RAMAKRISHNAN.
M.S. University of Baroda,
Baroda, India, July 17, 1957.

1. Ramakrishnan, C. V. and Martin, S. M., *Can. J. Biochem.*, 1954, **32**, 434.
2. Cheng, K. L., Kurtz, T. and Bray, R. H., *Anal. Chem.*, 1952, **24**, 1640.
3. Fiske, C. H. and Subba Row, Y., *J. Biol. Chem.*, 1925, **66**, 375.
4. Ramakrishnan, C. V. and Martin, S. M., *Nature*, 1954, **174**, 230.

THE FREE α -AMINO ACID NITROGEN CONTENT OF THE SKELETAL MUSCLE OF SOME MARINE FISHES AND INVERTEBRATES

IN the course of an investigation of the nitrogenous extractives of fresh fish muscle, the authors determined the α -amino acid nitrogen content of the aqueous extracts of the skeletal muscle in a number of marine fishes. The free α -amino acid nitrogen content was usually below 30 mg. N/100 g. of the wet muscle (Table I). These values were far lower than those recorded for lobster muscle by Kermack *et al.*¹ and also by Camien *et al.*² In the lobster the free α -amino acid nitrogen content accounted for 34-49% of the water-soluble non-protein nitrogen (N.P.N.) while in fish muscle it constituted usually about 6% of the N.P.N. (Table I). The determination of the α -amino acid nitrogen in crustacean and other invertebrate muscle therefore appeared to be necessary from the comparative aspect.

TABLE I

The values of nitrogen are given as mg. of nitrogen per 100 g. of wet muscle

S. No.	Name of fish	Non-protein nitrogen (N.P.N.)	α -amino nitrogen	α -amino N as % of N.P.N.
1	<i>Scoliodon</i> sp.	1096.0	71.69	6.5
2	<i>Sphyraena malleus</i>	1174.0	68.75	5.0
3	<i>Hilsa toli</i>	311.1	17.86	5.7
4	<i>Chirocentrus dorab</i>	272.1	16.81	6.2
5	<i>Tylosurus lieurus</i>	374.1	24.29	6.5
6	<i>Sphyraena obtusata</i>	(Not determined)		..
7	<i>Scomberomorus commersonii</i>	335.6	24.84	7.4
8	<i>Pampus argenteus</i>	353.0	20.32	5.8
9	<i>Decapterus russellii</i>	301.4	20.77	6.9
10	<i>Caranx hippos</i>	332.6	14.02	4.2
11	<i>Drepane punctata</i>	236.7	9.1	3.8
12	<i>Scatophagus argus</i>	296.1	23.81	8.0
13	<i>Sepioteuthis arctipinnis</i>	789.8	349.4	44.2
14	<i>Nepturus pelagicus</i> I	914.3	356.2	39.0
15	Do. II	473.9	210.3	44.4
16	<i>Penaeus indicus</i>	772.9	326.1	42.2
17	<i>Homarus vulgaris</i> I*	820.0	358.0	43.7
18	Do. II*	762.0	306.0	40.2
19	Do. III*	805.0	280.0	34.8
20	Do. IV*	749.0	369.0	49.3

* Values reproduced from Kermack *et al.*¹ for comparison.

Analysis of crab and prawn muscle carried out by us showed a high level of α -amino N, of the same order as for lobster reported by the above workers. Further, squid muscle also showed a similar high level of α -amino N (Table I).

The voluntary muscle, which forms the bulk of the edible portion, is known to differ in structure in the vertebrates and invertebrates. It is striated in the former, while in the latter, particularly in the lower phyla, it is unstriated. The difference in the levels of the free α -amino acid nitrogen in fishes and in crab, lobster, squid and prawns probably reflects significant differences in the chemical composition of their muscle. High levels of α -amino N appear to be characteristic of invertebrate muscle. In view of these interesting indications of a chemical differentiation between vertebrate and invertebrate muscle, further investigations are being continued.

The free α -amino acid nitrogen was determined by the method of Pope and Stevens.³ This method was also employed by Kermack *et al.*¹

The authors are grateful to Dr. S. Jones, Chief Research Officer, Central Marine Fisheries Research Station, for his valuable suggestions and permission to publish this note.

Central Marine Fisheries Research Station, N. K. VELANKAR.
Mandapam Camp, T. K. GOVINDAN, July 17, 1957.

1. Kermack, W. O., Lees, H. and Wood, J. D., *Biochem. J.*, 1955, **60**, 428.
2. Camien, M. N., Scarlet, H., Duchateau, G. and Florkin, M., *J. Biol. Chem.*, 1951, **193**, 881.
3. Pope, C. G. and Stevens, M. F., *Biochem. J.*, 1939, **33**, 1070.

MODIFICATIONS IN THE COLORIMETRIC ESTIMATIONS OF Mn AND Mo

WHILE conducting the colorimetric estimations of manganese by the periodate method and of molybdenum as thiocyanate, after reduction of any hexavalent Mo by stannous chloride, as described by Piper¹ (1944), the author found the following modifications helpful to avoid errors, unnecessary repetition of samples and waste of chemicals (Mukherjee,² 1956).

(a) *Mn*.—Presence of chlorine is a great hindrance for the development of the permanganate colour. Hence chlorine present as HCl in the sample extract has to be expelled and was done by slowly evaporating it to dryness till devoid of any smell. To this a fresh solution containing 1 g. ammonium persulphate was added and fumed strongly for 5 minutes on a hot plate. This ensured a complete colour development but

if t
little
give
(
mol
Pipe
dete
ther
cou
(the
rime
mod
colo
ing
ings
water
of e
plete
phas
brou
volu
desir
also
and
inter
know
(usin
435-6
are
the
conv
conta
ard
mete
amm
As
analy
Mn a
este
I
Dr. I
Dept.
D. M
Deor
•
Physic
Hindu
Micro
Minis
1. M
2. P

if the final colour was unsatisfactory, use of a little excess of periodate (K- or Na-) would give better results.

(b) Mo.—The visual colour comparison for molybdenum determination as suggested by Piper¹ (1944) is not a very reliable one for determining minute amounts of this element, as there is a considerable waste of ether. The error could be minimised by the use of a colorimeter (the author used Gallenkamp photoelectric colorimeter 3615/1 A—direct reading) with certain modifications while making the volume prior to colour comparison. The ethereal phase containing molybdenum thiocyanate and its later washings are transferred to a burette with a little of water (this also avoids any risk for the loss of ether), and left for a minute to allow complete separation of the ethereal and aqueous phases. Now the upper meniscus of water is brought to the lower mark of the burette and volume is noted by reduction (or made to any desired volume with ether). The standard is also similarly treated as the unknown samples and volume is made 25 c.c. Now the colour intensity of the standard as well as the unknowns are all compared against pure ether (using blue filter No. 621) wave-length: 435-80 m μ by a colorimeter. If all the volumes are not made equal for the unknown samples, the respective microammeter readings are first converted to standard's volume and then the content of Mo calculated either from a standard graph or directly from the calibrated ammeter factor (i.e., equivalence of each microammeter division to the content of Mo).

As workers in the field of microelement analysis may find this useful in the assaying of Mn and Mo, I am communicating this to your esteemed Journal for information.

I express my high sense of gratitude to Dr. K. N. Lal, for his invaluable guidance.

Dept. of Botany, K. L. MUKHERJEE.²
D. M. Degree College,
Deoria, March 26, 1957.

* Analyses of Mn and Mo were done at the Plant Physiological Laboratory, College of Agriculture, Banaras Hindu University, as a part of the original scheme on Microelement Nutrition of Sugarcane, sanctioned by the Ministry of Education (Research Training Scheme).

1. Mukherjee, K. L., "Role of Microelements in Metabolism and Growth of Sugarcane", Ph.D. Thesis, 1956.
2. Piper, C. S., *Soil and Plant Analysis*, Interscience Publishers, Inc., New York, 1944.

**RICCIA CROZALSII LEVIER AND
RICCIA WARNSTORFFII LIMPR.
FROM INDIA***

In an earlier communication the author (Udar¹) reported two species of *Riccia*, *R. sorocarpa* Bisch. and *R. huebeneriana* Lindenb., new to Indian flora and subsequently (Udar²) the presence of *R. billardieri* Mont. et N., a long lost liverwort, was shown as a segregate of the widely confused *R. himalayensis* St.-complex. A further examination of the extensive Pandé Collection (Lucknow University) has revealed the presence of two more species of *Riccia*, viz., *R. crozalsii* Levier and *R. warnstorffii* Limpr. not known from India so far. Both these species have a somewhat restricted geographical distribution being mainly confined to some European countries (see Macvicar,³ Müller,⁴ Arnell⁵ and Vanden Berghe⁶) and among the Asian countries *R. crozalsii* is known only from Israel (Proskauer⁷) whereas *R. warnstorffii* does not seem to have been noticed so far. The report of these two species from India is thus not only a welcome addition to the hepatic flora of this country but is equally important from the point of view of their range of distribution.

Both *R. crozalsii* and *R. warnstorffii* were collected by Dr. S. K. Pandé during his tour of South India in September-October 1950. The specimens, which are fertile, were carefully compared from authentic materials of both these species growing in England and obtained through the courtesy of Prof. A. C. Crundwell of Glasgow University.

The salient features are given below:—

***Riccia crozalsii* LEVIER**

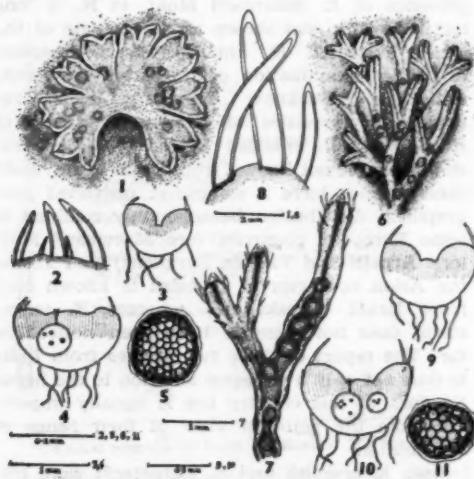
R. crozalsii is monoecious. The thalli are bluish-green and very small, being about 2 mm. long and .5 mm. broad. The segments are thick, anteriorly deeply sulcate and broadly channelled in the middle. The margin is conspicuously elevated and convex and studded with numerous cilia which are copiously aggregated towards the apex. The ventral surface is nearly semi-circular with the sides ascending to the acute margins. The ventral edges are more or less pink. The scales are small and purple-hyaline. In cross-section the thallus is nearly twice as broad as high. The sporophytes prominently project dorsally. The spores are 60-80 μ along the maximum diameter, tetrahedral, black, areolate, 8-10 areolæ across the outer face,

* Contribution from the Department of Botany, Lucknow University, New Series No. 24.

angles papillose; winged, wings upto 6μ wide, finely undulate.

Locality: Government Botanical Garden, Ootacamund, South India. *Date*: 9-10-1950.

Habitat: growing on red soil. Pandé Collection (Lucknow University). Specimen No. 3814. Figs. 1-5.



FIGS. 1-5. *Riccia crozalsii* Levier.

Fig. 1. Habit. Fig. 2. Cilia from the apical region. Figs. 3-4. Cross-section of the thallus behind the apex and in the middle. Fig. 5. Spore (outer face).

FIGS. 6-11. *Riccia warnstorffii* Limpr.

Fig. 6. Habit. Fig. 7. Mature thallus magnified. Fig. 8. Cilia from the apex of the thallus. Figs. 9-10. Cross-section of the thallus from behind the apex and in the middle. Fig. 11. Spore (outer face).

Riccia warnstorffii LIMPR.

R. warnstorffii is monoecious. The thalli are small, being upto 5 mm. long and .5 mm. broad, yellow-green and repeatedly branched. According to Jones³ they reach a maximum width of 1 mm. in this species. The segments are thick, linear, rounded at the apex, prominently sulcate anteriorly, somewhat broadly channelled in the middle and more or less flat posteriorly. The margin is thick, elevated and convex and studded with numerous large cilia in several rows. In cross-section the thallus is nearly twice as broad as high. The ventral surface is prominently convex with the sides ascending to the acute margins. The scales are violet, occasionally hyaline and so are the ventral edges.

The sporophytes bulge out prominently on the dorsal surface and at maturity are exposed in a row in the thallus depression formed by the decay of the overlying tissues. The spores are

50-70 μ along the maximum diameter, tetrahedral, blackish, areolate, 6-8 areoles across the outer face, angles papillose; winged, wings upto 8 μ , undulate.

Locality: South India. *Habitat*: growing on red soil. Pandé Collection (Lucknow University). Specimen Nos. 3802 (on way to Coonoor. Railway track). *Date*: 7-10-1950, 3817 (Government Botanical Garden, Ootacamund). *Date*: 9-10-1950, 5124, 5125 (Ootacamund). *Date*: 9-10-1950. Figs. 6-11.

This species is more common than *R. crozalsii*.
Dept. of Botany, Lucknow University, Lucknow, July 22, 1957.

RAM UDAR.

1. Udar, R., *Curr. Sci.*, 1956, **25**, 232.
2. —, *Ibid.*, 1957, **26**, 20.
3. Macvicar, S. M., *The Student's Handbook of British Hepaticae*, 1926.
4. Müller, K., "Die Lebermoose Deutschlands. Oesterreichs u. d. Schweiz I", *Rabenhorst's Kryptogamen-flora*, 1906-11, **Ed. 6**, Leipzig.
5. Arnell, S., *Svensk bot. Tidskr.*, 1950, **44**, 231.
6. Vanden Berghen, C., *Jardin Bot. de l'état*, 1955, **1**, 1.
7. Proskauer, J., *Palestine J. bot.*, *Jerusalem Series*, 1953, **6**, 123.
8. Jones, E. W., *Trans. Brit. bryol. Soc.*, 1955, **2**, 571.

HAPLOID CHROMOSOME NUMBERS IN THE TESTIS OF THE TERMITE KING *ODONTOTERMES REDEMANNI* (WASMANN)

NOTWITHSTANDING the great advances made in the field of cytology in the recent years, practically very little is known about the chromosome set-up in the somatic and the germinal cells of termites. Stevens³ was first to study the spermatogenesis in the termite, *Termopsis angusticollis*, wherein she reported 52 and 26 chromosomes respectively from the somatic and the germinal cells. Later, Benkert¹ noted 21 chromosomes from the primary spermatocyte of *Reticulotermes flavicola*. Light² confirmed Stevens' findings of 52 somatic chromosomes in *Zootermopsis* (= *Termopsis*) *angusticollis* and observed equal number of chromosomes in the somatic cells of an allied species *Z. navadensis*. Light's observations were particularly interesting since it hinted at the possible application of cytotaxonomy in the termite systematics, inasmuch that he pointed at the chromosome constancy at least at the generic level.

It is clear, however, that so far the chromosome study of only four American species of termites have been made and that there is no

record of the chromosome number of any Indian species of termite. While studying the spermatogenesis in the termite king *Odontotermes*

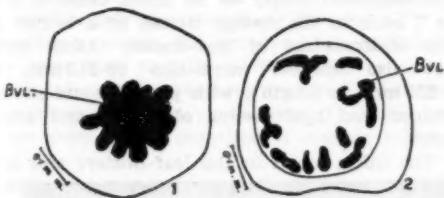


FIG. 1. Total view of the haploid chromosomes in the testis of the termite king, *Odontotermes redemannii* (Wasmann) at the bivalent stage. BVL-Bivalent.

FIG. 2. Structure of some testis chromosomes of *Odontotermes redemannii* (Wasmann). BVL-Bivalent.

redemannii (Wasmann), the author got opportunities to study the chromosome numbers in the testis at the primary spermatocyte stage. The haploid number of chromosomes appear to be 24 as against the 48 somatic chromosomes. The chromosomes at the primary spermatocyte stage appear as a clump of deeply stained bodies, while in total view look like a dense crowd heaped together on the primary spermatocyte plate.

Termite Res. Unit, BARUNDEB BANERJEE.*

Entomology Lab.,

Zoology Department,

University College of Science,

Calcutta, June 1, 1957.

* Present address: Department of Biology, Scottish Church College, Calcutta 6.

1. Benkert, J. M., *Proc. Penn. Acad.*, 1930, 4.

2. Light, S. F., *Anat. Rec.*, 1938, 72.

3. Stevens, N., *Carnegie Inst. Publ.*, 1905, 36.

CERCOSPORA LEAF-SPOT OF *RAUWOLFIA SERPENTINA* BENTH.

EARLY in September 1956, a severe leaf-spot disease was noticed to be widely prevalent in the plants of *Rauwolfia serpentina* Benth, grown at the State Agricultural Research Station, Bhubaneswar (Orissa). The disease starts on the leaf as a minute yellowish discolouration which gradually increases in size without definite demarcation lines. The spots turn dark brown with age on the upper surface of the leaf and yellowish brown on the lower surface. Olivaceous effuse fructification is produced on

the lower leaf-surface (Fig. 1). A large number of such areas appear on each leaf and on increasing in size some of them coalesce to form large patches. The affected leaves turn yellow, dry up and fall off resulting in defoliation.

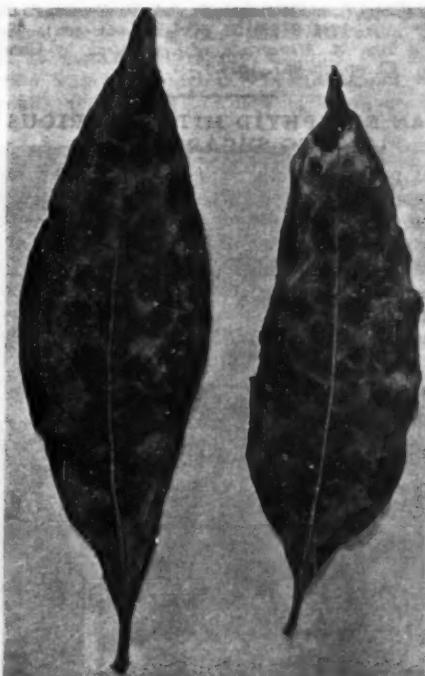


FIG. 1. Leaves of *Rauwolfia serpentina*, showing effuse fructification on the lower leaf surface.

The pathogen causing this disease was identified as *Cercospora rauwolfae* Chupp & Muller. The conidiophores of the fungus occur in dense groups. They are pale to medium dark brown in colour, more narrow towards the tip, variously curved, rarely branched, multiseptate and measure 3 to $4.5 \mu \times 10$ to 68μ . The conidia are pale olivaceous in colour, cylindric, straight to slightly curved, 1- to 5-septate, base subtruncate to long obconically truncate, tip obtuse and measure $2.7 \mu \times 15$ to 60μ . The characters of the fungus under report in all respects agree with the characters of the fungus *Cercospora rauwolfae* described by Chupp & Muller (1942), except that the conidia are slightly more narrow and longer than the type of *Cercospora rauwolfae* Chupp & Muller.

The authors are indebted to the Director, Commonwealth Mycological Institute, Kew, England, and Prof. Charles Chupp of Cornell

University, U.S.A., for their help in identifying the fungus.

Mycology Section, N. N. MANTY.
Utkal Krushi Mahavidyalaya, S. K. D. B.
Bhubaneswar, July 10, 1957.

1. Chupp, C. and Muller, A. S., *Bol. Soc. X. venez. Z. Cien. Nat.*, 1942, 8(52), 54. (Original not seen). (Seen from *A Monograph of Cercospora*, by Charles Chupp, pp. 667, 1954.)

AN ERIOPHYID MITE INJURIOUS TO SUGARCANE

THE present note is a record of blister mite, *Eriophyes* sp. (Eriophyidae, Acarina), on sugarcane in Belgaum, Mandya and Bangalore Districts. Muthukrishnan¹ previously recorded it from the Madras State. The damage caused by this mite is very characteristic and can be recognised readily by the external leaf-sheath scars (Fig. 1) on the undersurface of which

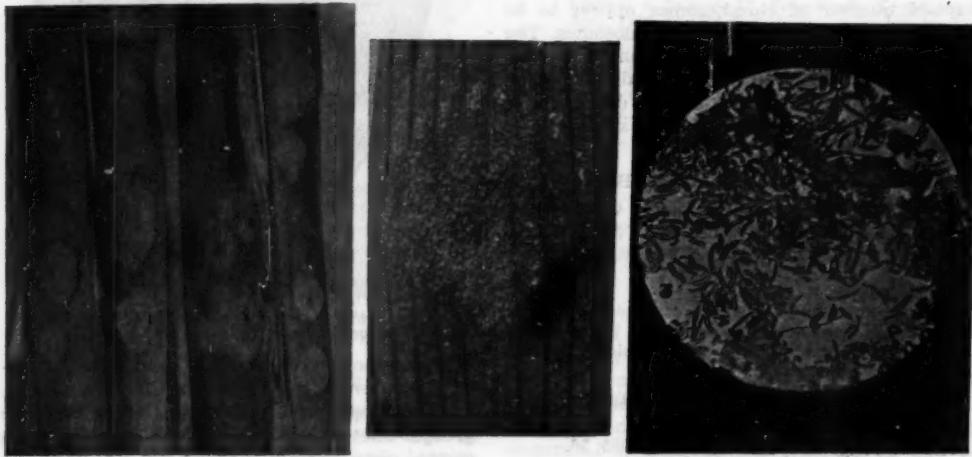
lesser pests of sugarcane so far, but it seems to be spreading very fast.

Eggs (Fig. 3 a) are transparent (measuring on an average 0.078 mm. \times 0.063 mm.). These are deposited singly or in small clusters of 5 to 7 each in the spongy tissues of a blister on the undersurface of leaf-sheath. Adult mites are also minute, worm-like (0.210 mm. to 0.252 mm. in length), with propodosoma shield-shaped and hysterosoma elongated and annulated.

The mites breed in the leaf-blister and give rise to many overlapping generations; as evident from the presence of all stages of mite in the colonies in a blister. One life-cycle occupies about 15 days at a room temperature ranging from 71 to 84° F.

Further detailed studies are in progress.

Division of Entomology, M. PUTTARUDRIAH.
Department of Agriculture, S. USMAN.
Bangalore, August 9, 1957.



FIGS. 1-3. An Eriophyid mite injurious to sugarcane.

Fig. 1. External scars on leaf-sheaths; Fig. 2. A blister on the undersurface showing colonies of mites; and Fig. 3. Mites and eggs (a).

blisters, measuring 12 mm. \times 9 mm., have been caused (Fig. 2). In a very early stage of attack, the external scar is not discernible, though the blister containing a colony of developing mites may be seen on the undersurface. The blisters are found between the leaf-sheaths or between the leaf-sheath and the stem, but no blister or any other apparent injury due to mite is noticed on the cane proper. Both grown-up and young canes, including ratoon canes, are subject to attack by the mite. In status this mite is one of the

1. Muthukrishnan, T. S., *Curr. Sci.*, 1956, 25, 234.

DIFFERENTIATION WITHIN THE TETRAPLOID RACE OF *SISYMBRIUM IRIO* COMPLEX

The tetraploid race does not only occupy diverse habitats but is also morphologically variable. In the autumn of 1952, sixty-five selections of this race were grown in an uniform habitat (moist-sun) and as such the influence of varied

[No. 2
Sept. 1957]

environments was altogether removed. A direct comparison of the genotypes was rendered possible. It became apparent that these 65 selections could be relegated to only 3 types which differ in morphology of the vegetative characters, particularly the branching pattern.

Pending a search for synonymy, these three types have been tentatively designated as *caulis*, *subcaulis* and *acaulis* according to the nature of the main stem. In *caulis* (Fig. 1), there is a main stem which branches at regular inter-

vals and finally it ends in a flowering shoot. In *subcaulis* (Fig. 2) the main stem is reduced to only one node after which it immediately ends in flowering shoot. In this type most of the branches arise from the axils of the ground leaves. The *acaulis* (Fig. 3) has no main stem whatsoever and it produces flowering shoots directly. Out of these three, only two (*caulis* and *subcaulis*) types were cultivated in four 'water-light' habitats laid close to one another in the Students Farm of the Khalsa College. The four habitats were dry-sun, dry-shade, moist-sun and moist-shade.

daughter plants grow. On the contrary, the total range in height in *subcaulis* was only between 25-80 cm. (cf. Fig. 4). No doubt, the smallest plants of this type were obtained in dry-sun but these were about 21 times taller than the smallest plants of *caulis* grown in this very habitat (25 cm. against 1.2 cm.). Furthermore, the size of the plants increases in moist in comparison to dry habitats but the increase is gradual and not as spectacular as in *caulis* (cf. Fig. 4). There is, however, a



FIGS. 1-3. Tetraploid race of *Sisymbrium irio*. Fig. 1. *Caulis*, $\times 1/13$. Fig. 2. *Subcaulis*, $\times 1/9$; Fig. 3. *Acaulis*, $\times 1/4$. All of the same age.

vals and finally it ends in a flowering shoot. In *subcaulis* (Fig. 2) the main stem is reduced to only one node after which it immediately ends in flowering shoot. In this type most of the branches arise from the axils of the ground leaves. The *acaulis* (Fig. 3) has no main stem whatsoever and it produces flowering shoots directly. Out of these three, only two (*caulis* and *subcaulis*) types were cultivated in four 'water-light' habitats laid close to one another in the Students Farm of the Khalsa College. The four habitats were dry-sun, dry-shade, moist-sun and moist-shade.

The response of the two types of tetraploid to various habitats is depicted in Fig. 4. The *caulis* behaves the poorest in dry-sun being from 1.2 to 5 cm. tall while in moist-shade the plants reach a height of 150 cm. The progeny of the original plant of *caulis* could therefore achieve any height between 1.2 to 150 cm. depending chiefly on the habitat in which the

distinct fall in plant height (60-65 cm. in moist-shade vs. 60-80 cm. in moist-sun) in moist-shade. Coupled with this fall there is a decrease in number of seeds per siliqua accompanied by 8-10% abortive seeds.

From the above data, it can be reasonably concluded that *caulis* is essentially a type suited for moist habitats while *subcaulis* for dry as well as moist habitats but it shows signs of decline in moist-shade. This conclusion is in line with the field observations. In addition to these, the *acaulis* type has been almost always found to be restricted to moist grazed habitats.

It is reasonable to assume that the habit of the three types of tetraploid has an adaptive value. The *caulis* grows in moist habitats and it has therefore a luxurious vegetative system in the main stem. The *subcaulis* grows in dry habitats where, due to the limitations of water, the emphasis is on producing reproductive shoots as soon as possible. This has been achiev-

ed by reduction of the vegetative portion of the main stem. Lastly, in *acaulis* vegetative system of both the main stem and branches is altogether absent since under biotic influence of grazing the plants with an extensive vegetative system would be at a great selective disadvantage. In this type, the reproductive shoots arise directly.

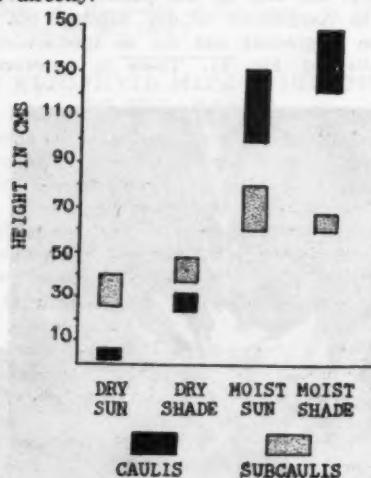


FIG. 4

The three types are interfertile and the genetic basis for their differentiation is being studied.

It is not as yet possible to comment on the exact biosystematic status of the three types because so far cultivation studies have been primarily limited to the plants growing in and around Amritsar. Considering the wide geographical range of the species,¹ it is quite possible that these types are only local variations within bigger regional groupings which are yet to be unravelled.

The phenotypes obtained in the four gardens were critically compared for individual plant organs. This comparison revealed those characters which were not modified or were modified but little. Such characters would be ultimately used as 'key characters' in the subsequent classification.

I am deeply grateful to Prof. P. N. Mehra for his keen interest, advice and encouragement, to Mr. R. S. Pathania for photographs and to Mr. B. Khanna for help with Fig. 4.

Dept. of Botany,
Panjab University,
Amritsar, March 18, 1957.

T. N. KHOSHOO.

1. Khoshoo, T. N., *Nature*, 1955, 176, 608.

CAUSE FOR THE FAILURE OF SEED-SETTING IN THE CROSS *CORCHORUS OLITORIUS* \times *C. CAPSULARIS*

Corchorus olitorius and *C. capsularis* are both cultivated species of jute and hybridization between them has been attempted for many years in order to combine the desirable characters which they possess. Since this cross does not succeed normally, techniques such as smearing the stigmatic exudate from the pollen parent on the stigma of the pistillate parent, reducing the length of the style in *C. olitorius*, using mixed pollen and attempting the cross after producing tetraploids of the two species have all been tried but no viable hybrid seed has so far been obtained.¹ Srinath and Kundu² studied the causes for the failure of seed setting in this cross and observed that the growth of the pollen tubes in the style of the pistillate parent is normal. This suggests that post-fertilization abnormalities are probably responsible for the failure of the cross. The present study was undertaken to ascertain the precise mechanism controlling the cross-incompatibility reaction in these species.

Periodic sowings of the seeds of the two species were made at fortnightly intervals during the period January 1955 to August 1956. It was found that *C. olitorius* behaves like a period-fixed strain under Delhi conditions, the plants commencing flowering eight weeks after sowing throughout the year. *C. capsularis*, on the other hand, flowered only during a very limited period extending from the beginning of September to the first week of October. September was, therefore, the only month when flowering was synchronised in the two species and nearly 1,000 reciprocal pollinations were then made. In all the crosses with *C. capsularis* as the pistillate parent, the flowers dropped within three days after pollination. This did not occur when *C. olitorius* was the pistillate parent and in this cross, the ovaries with style and stigma were fixed in Formalin-Acetic-Alcohol, one day and 3, 5, 10, 15, 18, 20, 25, 30 and 40 days after pollination. Ovaries fixed from selfed flowers of *C. olitorius* at the same intervals of time after pollination served as controls. The material was embedded, sectioned at 12 microns in the case of the young ovaries and at 16 microns in the case of those older than 10 days, and stained with haematoxylin.

A summary of the observation recorded is given in Table I (see also Figs. 1-3).

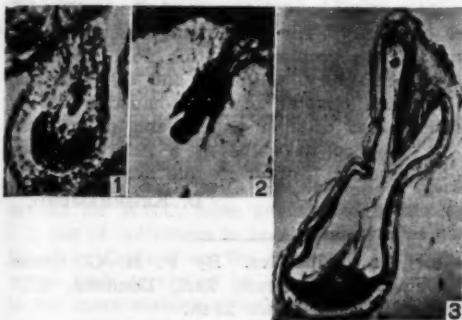
The data show conclusively that (a) fertilization takes place normally in the cross, and (b) premature abortion of embryos leads to the

failure of seed-setting. Prior to the collapse of the seed, the hybrid proembryos and embryos differentiate normally. The only observable difference is some reduction in size as compared with the control. The endosperm, on the other hand, grows differently from the very early stages. The rate of nuclear division is slower and the tissue does not show any evidence of becoming clearly

by hybridization. It could therefore be concluded that the abortion of the young seed is attributable to an impaired capacity for growth of the endosperm, which itself in turn may be due to the tendency of the adjacent maternal tissue to develop excessively. This type of failure of seed-setting has been termed by Cooper and Brink³ as somatoplasic sterility and has been recorded in many distant crosses.⁴ Since this is essentially a malnutritional phenomenon associated with the genotypic diversity of the tissues within the seed, it would be possible to overcome this barrier by culturing the young embryos *in vitro*, provided they reach an excisable and culturable size.

Several embryos in the cross between *C. olitorius* and *C. capsularis* reach the heart-shaped stage and there are hence possibilities for raising hybrid seedlings by culturing them in suitable media. We are presently engaged in this line of work and have already standardised a medium in which heart-shaped embryos of *C. olitorius* grow and differentiate normally. Other techniques such as embryo transplantation are also being tried and the results will be reported separately.

We are indebted to Dr. B. P. Pal and Dr. S. M. Sikka for their interest in the study and advice.



Figs. 1-3. L.S. of ovaries of *C. olitorius* following pollination with *C. capsularis*.

Fig. 1. 24 hours after pollination. The pollen tube could be seen entering the embryo sac.

Fig. 2. 18-day-old seed showing a proembryo.

Fig. 3. Mature seed (45-day-old). A small globular embryo and the ill-developed free nucleate endosperm are seen.

Indian Agric. Res. A. T. GANESAN.
Inst., New Delhi-12, S. S. SHAH.
June 10, 1957. M. S. SWAMINATHAN.

TABLE I

Days after pollination	<i>C. olitorius</i> (selfed)	<i>C. olitorius</i> × <i>C. capsularis</i>
1 day to 3 days	.. Pollen tube reaches the embryo sac. Discharge of male nuclei takes place between 24 and 72 hours	Same
3 days	.. Fertilization takes place. The endosperm nucleus starts dividing and the egg undergoes a short rest period	Same
15 to 20 days	.. Endosperm divides rapidly, and the initially free-nucleate endosperm becomes cellular. Embryo reaches the heart-shaped stage	Endosperm division is very slow and only a few nuclei (40 to 60 usually) are found in thin strands below the embryo. No prominent cell wall development is seen. Proembryos are seen
40 to 50 days	.. Seeds are mature, containing a well differentiated embryo and cellular endosperm with many inclusions	Seeds are shrivelled. Endosperm is poorly developed, and largely free nucleate. Globular and rarely heart-shaped embryos occur

cellular. No mitotic disturbances are, however, visible. The adjacent maternal tissue appears to be better developed in comparison with the controls, though pronounced hyperplasia is not seen. Thus, among the four principal tissues in the young seed, namely, embryo, endosperm, nucellus and integument, the embryo is least altered in form and early development

1. Kundu, B. C., *Economic Bot.*, 1956, 10 (2, 3), 103, 203.
2. Srinath, K. V. and Kundu, B. C., *Cytology*, 1952, 17, 219.
3. Cooper, D. C. and Brink, R. A., *Genetics*, 1940, 25, 593.
4. Brink, R. A. and Cooper, D. C., *Bot. Rev.*, 1947, 13, 423.

REVIEWS

Text-Book of Polymer Chemistry. By Fred W. Billmeyer, Jr. (Interscience Publishers), 1957. Pp. viii + 518. Price \$10.50.

The extensive series of researches carried out on the physics, chemistry and technology of high polymers during the past two decades with fruitful applications in the evolution of plastics, elastomers and synthetic fibres of diverse physical properties have formed the subject-matter of several monographs on high polymer science brought out by Interscience Publishers. The present book is an attempt "to gather into one location and to classify some of the more interesting and important information about polymeric substances" for use with graduate level courses in the chemistry of high polymers.

Apart from the introductory part, the book consists of five other parts dealing with the physical chemistry of polymers, kinetics of polymerization, and the properties of plastics, fibres and elastomers. In the section on the physical chemistry of polymers are discussed the methods for the elucidation of their structure, their rheological behaviour, the thermodynamics of polymer solutions, and the determination of molecular weights from studies on the behaviour of polymer solutions, e.g., elevation of boiling point, viscosity and osmotic pressure variations, sedimentation rates and the scattering of light. It may be remarked here that the author is factually inaccurate in stating in Chapter 13 that the details of the relationship between the intensity of light scattering and solute molecular weight were first elucidated by Debye and his co-workers in 1943. This relation had actually been derived and its applicability to the opalescence of protein solutions recognized by Sir C. V. Raman as early as the year 1927 in his paper on the "Relation of Tyndall Effect to Osmotic Pressure in Colloidal Solutions" (*Ind. Jour. Phys.*, 1927, Vol. II, pp. 1-6).

The rates of reactions, the role of initiators and inhibitors of reactions and their relation to the size of the polymer chain and several typical examples of polymerization and their thermochemistry are but some of the various topics that are discussed in the section on the kinetics of polymerization. The last three sections deal with the properties of plastics, fibres and elastomers, their structure, the methods of their production and their uses, and serve to

emphasize the vast developments that have taken place in the industrial production of these high polymers.

This well-written and concise treatise touching on every important aspect of the subject should prove a useful text to students of polymer chemistry. The stimulating discussions on some of the problems in this field requiring more satisfactory solutions and the provision under each chapter of an exhaustive list of references to original papers and other textbooks enhance its value as a reference book to the research worker in this field.

D. KRISHNAMURTI.

Switchgear Principles. By P. H. G. Crane. (Cleaver-Hume Press, Ltd., London), 1957. Pp. viii + 238. Price 25 sh.

The book is intended to meet the need for a general understanding and a concise survey of the problems of circuit breaking, of the various methods available and of the apparatus for putting them into practice. The author has presented a balanced picture of the theoretical understanding and practical economic engineering demanded by a good switchgear practice.

There are ten chapters. The first chapter deals with the general consideration of the supply and control of electricity indicating the modern trend in grid systems, operating voltages, Busbar arrangements and different transmission systems.

The second chapter deals with the causes of short circuits and overvoltages in power systems and their consequences. The problems of power system stability, short circuit and unsymmetrical fault currents and their calculations are discussed in some detail. The author, however, has not used the m.k.s. units. The per unit method of fault calculations would have been preferable to the percentage method used. The assumption that currents of any particular phase-sequence produce voltage drops in that phase-sequence impedance only is true, only if the power system is balanced under normal conditions in a symmetrical three-phase system, but rendered unbalanced by an unsymmetrical fault.

The third chapter deals with the general problems of protection and protective schemes with circuit breakers. The operating sequences of circuit breakers and the currents and voltages

obtaining in the circuit breakers during operation has been very well explained.

The next two chapters deal with the phenomena of electric discharges and the principles of circuit breaking. After discussing the problems in D.C. and A.C. circuit breaking, the author has explained very well the conditions obtained in restriking voltages, current zero pause and current chopping. The different approaches to circuit-breaker ratings between American and British methods have been discussed in detail.

A chapter each has been devoted to different types of oil circuit breakers, air circuit breakers and to switchgear components. Switchgear recommendation, both for indoor and outdoor use, is discussed in a separate chapter. The last chapter deals with the tests and specifications for H.R.C. fuses and circuit breakers.

A list of references to books and articles published in England on the subject is included.

The book serves as an excellent introduction to the more elaborate books on switchgear and very well meets the need for a comprehensive text-book for students in electrical engineering who are expected to learn some basic facts about the principle and operation of switchgear. The book will also be of interest and assistance to the user of switchgear, as a source of general information.

C. S. GHOSH.

Man-Made Fibre Progress. (*Annals of the New York Academy of Sciences*, Vol. 67, Art. 11, Pp. 897-982.) Edited by J. J. Press. (Published by the Academy), 1957. Price \$ 3.00.

This slim monograph is a collection of articles written by specialists on various recent developments in the production and use of man-made fibres. One article deals with the chemistry of producing and processing the "re-generated" fibres, namely, viscose and cellulose acetate. Two articles are devoted to the production of truly "man-made" fibres, such as orlon, decron, and nylon, while another deals with the dyeing and finishing of these. There is a very interesting chapter on the relation between the temperature and moisture content of a fibre and its performance. This chapter defines the first and second order transition temperatures of fibres and describes the importance of these temperatures in operations such as ironing and "tumble-drying". The last chapter gives an account of an attempt to evaluate, in quantitative terms, the various factors which contribute to a user's appreciation of textile fabrics. All articles are written in a style which is not too technical for non-spe-

cialists. The book can be recommended to all who wish to acquaint themselves with the rapidly expanding progress in the field of man-made fibres.

T. R.

An Introduction to the Cathode Ray Oscilloscope. By Harley Carter. (Popular Series.) (Philips Technical Library), 1957. Pp. 100. Price 12 sh. 6 d.

The great facility with which, recurrent as well as transient, electrical and non-electrical phenomena can be displayed and measured to a high degree of precision has put the cathode ray oscilloscope as an indispensable tool in research laboratories and to an increasing extent in industries. The book under review concerns itself with the basic principles of operation of cathode ray tubes and associated circuit elements, and is primarily intended as a guide to technicians, shop engineers and students who have had only a brief acquaintance with electronics. Descriptions of the component parts of the cathode ray tube and their functions, the principles of operation of several types of time base circuits, amplifiers for vertical deflection, pick-ups for converting non-electrical phenomena into electrical magnitudes and power supplies are briefly treated with copious illustrative diagrams. Practical applications of the oscilloscope are indicated. Four complete oscilloscope circuits employing Philips component parts are given, preceded by a data sheet of Philips cathode ray tubes.

A. JAYARAMAN.

International Review of Cytology, Vol. 5. Edited by G. H. Bourne and J. F. Danielli. (Academic Press, Inc.), 1956. Pp. vii + 570. Price \$ 11.50.

The rise of several new disciplines has expanded the scope of cytology and the boundary between cell morphology and physiology has become rather tenuous. This is reflected in the wide range of topics discussed in the volume under review.

The problem of cell secretion in the pancreas and the salivary glands is considered by Junquiera and Hirsch and recent advances in the cytology of spermatogenesis reviewed by Viswa Nath. The acrosome of the sperm has intrigued investigators. The species specificity of fertilization in Nature is not absolute under experimental conditions. Dan reports on the "Acrosome Reaction" and suggests that only further investigations would fix the specificity of the fertilization reaction on the lysins present in the acrosome.

Vendrel and Vendrel present the recent advances in the study of DNA content of the nucleus by cytophotometry. It would appear that the present trend is to discard the idea of Pasteels and Lison and adopt as a working hypothesis the constancy in the DNA content of the nucleus. "The DNA which appeared to the cytologist as a variable element fixed upon the chromosomes during mitosis and of genetic importance, appears, in fact, as a quantitatively constant element of the nucleus and an important component of the chromosomes" (p. 194).

There are interesting contributions on "Protoplasmic Contractility in Relation to Gel Structure" (Marsland), "The Chemical Composition of the Bacterial Cell Wall" (Cummins), "Intracellular pH" (Caldwell), "Histochemistry with Labelled Antibody" (Coons), "Theories of Enzyme Adaptation in Microorganisms" (Mandelstam), "Uptake and Transfer of Macromolecules" (Schechtman), and "The Activity of Enzymes in Metabolism and Transport in the Red Cell" (Prankerd).

The mitochondria of the cardiac and skeletal muscle have received special attention in regard to the role they play in the enzyme mechanisms of muscular systems (Harman). The most thought-provoking contribution is that of Sjöstrand on the ultra-structural organization of cells. He remarks: "It is striking how few really new structural components have been revealed by the electron microscope as compared with the careful classical light microscope studies". "For the moment it is reasonable to state that the electron microscope studies have not contributed any new, really basic concepts in cell research" (p. 456).

He sounds a note of warning that the data obtained with the electron microscope should be used with caution by biochemists, especially in studies of fragmented mitochondria. Membranes presumed originally to belong to mitochondria are said to appear in every cell fraction and hence they are suggested to be either the numerous membranes observed in the cytoplasm or artificial formations in lipid protein mixtures.

The volume is a welcome addition to any library.

M. K. SUBRAMANIAM.

Spot Tests in Organic Analysis. By Fritz Feigl. (Elsevier-Cleaver Hume Press), 1956. Pp. xx + 616. Price 55 sh.

The volume under review is the fifth edition of the well-known publications of Prof. Feigl, the second volume of the previous edition now

appearing as an independent one. The text has been extended appreciably, a change that will be welcomed by teachers of Analytical Chemistry. The role of spot tests has been progressively on the increase and the close relationship between the choice of organic reagents for inorganic analysis and the problems of qualitative organic analysis have been well brought out. The six chapters cover every aspect of the application of spot test technique with adequate examples and there is enough material provided for the investigator in the field even if one were to make a start. Every test includes not only the principle involved but a detailed indication of the procedure to use and a study of the volume should make it possible for a scheme of analytical technique, even in undergraduate courses, which is systematic, elegant and economical. With courses at Universities in the country undergoing changes, the volume is a very opportune publication that should find a place in every laboratory training students in the techniques of analytical chemistry. A feature that the reviewer should particularly mention is the large number of specific tests which require the use of only reagents that are readily available in any advanced laboratory. The general get-up of the book is of the usual high standard of Elsevier publications.

S. V. ANANTAKRISHNAN.

Colorimetric Analysis. Vol. I. (Second Edition.)

By N. L. Allport and J. W. Keyser. (Chapman and Hall), 1957. Pp. xi + 424. Price 50 sh.

In the twelve years that have lapsed since the publication in one volume of the first edition of this well-known book, colorimetric methods of analysis have vastly increased in scope and number. This has necessitated expanded coverage of the subject in two volumes. The present volume is confined to clinical and biochemical analyses while Volume Two is expected to deal with colorimetric procedures applicable to metals, foods and pharmaceuticals.

Methods for the determination of over a hundred constituents of clinical and biochemical significance are detailed. The alphabetical arrangement is easy to refer. Each chapter includes a very brief introduction mentioning various available methods, precise details of a selected procedure with illustrations wherever any special apparatus is required and a discussion covering the specificity of the method and other special comments. No theoretical considerations are included and attention is focussed

N
entire
thera
haus
desc
satis
ever
each
fulne
porta
meth
nati
amon
choli
strep
Th
to be
rouni
The
(S
rim
(C
Pp
Nin
grow
Symp
Biol
of th
rema
prob
cal o
devel
grow
anim
regul
tumo
ence
discu
not b
F.
the r
tion
of v
thus
nutri
mech
dicate
fracti
germi
asses
the r
auxin
devel
syner
mona
phase

entirely upon procedural aspects. The book is therefore more a laboratory manual than an exhaustive reference book. Methods selected for description are often those that have proved satisfactory in the hands of the authors. However, a short list of references is included for each constituent which should add to the usefulness of the book as a whole. There are important omissions such as for example in the methods for blood glutathione assay. Determinations that could have been included are, among others, those for *p*-aminobenzoic acid, choline, histamine, vitamin K, penicillin, streptomycin and thyroxine.

The book, like its predecessor, will continue to be a valuable aid to laboratories engaged in routine biological analyses.

A. S.

The Biological Action of Growth Substances. (*Symposium No. XI of the Society for Experimental Biology.*) Edited by H. K. Porter. (Cambridge University Press, London), 1957. Pp. 344. Price 55 sh. net.

Nineteen papers on the biological action of growth substances, presented at the Eleventh Symposium of the Society for Experimental Biology, are compiled in this volume; ten out of these deal with botanical problems and the remaining nine with animal physiology. The problems on the botanical side relate to apical dominance, germination, root growth, fruit development, tropisms, chemical regulation of growth and sexuality in lower plants; on the animal side, problems connected with endocrine regulation, insect hormones, and foetal and tumour growth are considered. A brief reference to some important points brought out in discussions on plant physiological problems may not be out of place.

F. G. Gregory and J. A. Veale suggest that the main factor in apical dominance is nutrition and that auxin controls the development of vascular tissues to the axillary buds and thus by a secondary effect deprive the buds of nutrients of all kinds. M. Evenari reviews the mechanism of germination inhibitors and indicates their importance in seed dispersal, in fractionated germination and in confinement of germination to suitable habitats. H. Burström assesses the present position of his theory of the mechanism of root growth in relation to auxin. L. C. Luckwill reviews the topic of fruit development and suggests that auxins act synergistically with some other types of hormonal factors (at present unknown) in the early phase of fruit growth (exception: Solanaceae

and Cucurbitaceae) and that a number of different compounds may be involved in controlling increase in size of fruits, abscission, maturation, etc. He also believes that IAA may not be of such universal occurrence in higher plants as has been generally supposed. L. Brauner's paper amply illustrates that the mechanism of the perception of the photoperiodic stimulus by the oat coleoptile remains obscure as ever. F. Skoog and C. O. Miller discuss how quantitative interactions between IAA, kinetin and other factors regulate growth from cell enlargement to organ formation. A. C. Braun discusses the nature of autonomous growth in neoplastic plant cells and concludes that a cell acquires the capacity for uncontrolled or autonomous growth as a result of permanent blocking of several growth substance synthesizing systems that are concerned with the development of growth by cell division.

The literature on the subject of growth substances is expanding very rapidly and as such periodical discussions by competent authorities are very valuable for the assessment of progress in this branch of science. For this purpose, this volume should find a place on the bookshelf of every laboratory that is interested in the study of growth substances.

R. D. ASANA.

The Liver: Some Physiological and Clinical Aspects. (*British Medical Bulletin*, Vol. 13, No. 2, May 1957.) (Published by the Medical Department, The British Council, 65, Davies Street, London, W.1.) Price 20 sh.

Once again the Editorial Committee of the *British Medical Bulletin* has rendered a signal service to medical science by bringing out the present number on liver and putting within one purview the available knowledge on physiology, biochemistry and pathology of this gland whose vital role in many basic metabolic processes is now well recognized. The previous Bulletins of the series covering such widely divergent fields as neurology and blood coagulation, have been acclaimed by one and all and there is no doubt that the present one on the liver will be received with the same note of welcome.

The Bulletin incorporates altogether 15 contributions dealing with virtually every aspect of liver physiology, biochemistry and pathology. Each article is written by a specialist and is well-documented with references to relevant works. Factual data from personal observations are often adduced by the contributors when making an important statement. The illustra-

tions are excellent and the tabulated data wherever they are given, are lucid to the extent of being self-explanatory. The net result of such approach to the various aspects of the complicated liver problem has been that the reader gets up-to-date informations; and taken as a whole this is a most useful feature of the present Bulletin. Further, a commendable effort has been made to indicate the aspects of the liver problem in which the integration of the physiological and pathological knowledge has been either achieved or foreshadowed. It is superfluous to point out that any advancement in medical science today depends on an effective junction between physiology, biochemistry and pathology and it is gratifying to note that this fact has been constantly kept in view by all those who have contributed towards the success of this Bulletin.

The reviewer is, however, of the opinion that a section on liver function tests would have made the Bulletin more useful to the practising physician. Nevertheless, this suggestion is made out of more practical consideration and as such does not distract the scientific importance of the Bulletin in any manner.

In fine, the publication of this number of the *British Medical Bulletin* is timely and the Editorial Committee deserves our hearty congratulations.

N. N. DE.

Technological Research on Cotton in India. By C. Nanjundayya. (Technological Laboratory, Indian Central Cotton Committee, Bombay), 1956. Pp. 205. Price Rs. 3.

The third edition of this book is an up-to-date presentation of the work carried out at the Technological Laboratory, Bombay. Here is a wealth of information which should be of value to fibre scientists and technologists alike. A large part of this volume deals with the measurement of the physical properties of Indian cotton and the assessment therefrom of its spinning value. As can be expected, data are presented to demonstrate the effect of fibre properties such as length, fineness, maturity and strength on yarn properties and performance. Much attention is paid to the methodology of measurements on fibres. The size of an adequate sample, the modifications of existing testing procedures, and the performance of some new types of test are discussed. The effects on yarn quality of various processing conditions and parameters such as the nature of the blow-room treatment, draft distribution, yarn twist, etc., are described. There are also some fascinating "extra-curricular" topics, such

as the state of cotton technology in the Mohenjodaro civilization.

The subject-matter of this book is presented in the form of summaries of all the past publications of the laboratory. It is rather unfortunate that there is no attempt to present the work to the reader as an integrated contribution to our knowledge of fibre science. Nevertheless, this moderately priced volume can be warmly recommended to the libraries of textile laboratories and mills.

T. R.

A Hand-Book of Some South Indian Weeds. By C. Tadulingam and G. Venkatanarayana. Revised and enlarged by C. Rajasekhar Mudaliar and J. Sakharam Rao. (Government Press, Madras), 1955. Price Rs. 7.

The first edition of this book was published in 1932 and it has been revised and enlarged in 1955. In the first edition, 108 South Indian Weeds had been described and in the revised edition, 64 more have been added. These fall under 44 natural orders of angiosperms, besides two cryptogamic weeds of importance. Fifty of the weeds are described in detail and are illustrated.

The first 60 pages are devoted to a few brief chapters in which is furnished information of a general nature on the parts and nomenclature of plants, weeds and their classification, special weeds, uses of weeds and losses caused by them. The chapters on how the weeds spread and methods of their control and the one on chemical control of weeds are of special importance as they furnish valuable information. Description and notes on weeds occupy the major part of the book with over 380 pages devoted to it. The glossary and indexes furnishing English and vernacular names, bibliography and errata are useful addition to the book. The inclusion of Hindi names will help in a wider use of the book.

Although the book deals mainly with South Indian weeds, it is observed that several of them are common throughout the country. The more important weeds are described in detail giving information, their distribution, habit, economic use, if any, and method of control. The less important are briefly treated. The information given on classification, spread of weeds and their control is of such general importance that the book will prove useful not only to workers in South India but to similar persons all through the country. The book will be specially of use to students of agriculture and agricultural workers.

L. S. S. KUMAR.

No.
Sept.

Journal
No.
sity.

The
Journal

duction
sections

a third
papers

in Ge
and on

Journal
tained
of the

papers
mainta

Journal
additio

Books

Vitamin

Publi

Pp. .

Transp

At t

in Was

phone

magneti

section

TV at

the dis

It coul

opposit

polaris

a sma

distorte

teresis

High-F

The

rushin

long be

by a fi

sphere

had be

What

up stil

Journal of the Karnatak University, Vol. I. No. 1. (Published by the Karnatak University, Dharwar.)

The Science Number and first issue of the *Journal of the Karnatak University* is a production of 191 pages, divided into three main sections, transactions, articles and notes. Nearly a third of the space of it is taken up by research papers in Organic Chemistry. There are two research papers in Physics, two in Botany, two in Geology, one in Zoology, one in Statistics and one in Analytical Chemistry. In University Journals of this type, standards can be maintained only by the self-restraint and objectivity of the authors. It is gratifying that the research papers in general come up to the standards maintained in long-established Journals. The Journal is very well produced and is a welcome addition to scientific literature.

T. R. G.

Books Received

Vitamin A. By Thomas Moore. (Elsevier Publishing Company, London W. 8), 1957. Pp. xx + 645. Price 76 sh.

The Chemistry of Heterocyclic Compounds—
The 1, 2, 3 and 1, 2, 4 Triazines, Vol. X. By John G. Erickson, Paul F. Wiley and V. P. Wystrach. (Interscience Pub.), 1957. Pp. xi + 261. Price \$10.50.

Laboratory Manual of Organic Chemistry. By B. B. Dey, M. V. Sitaraman and T. R. Govindachari. (S. Viswanathan, 11, McNichol Road, Chetpet, Madras-31), 1957. Pp. xiv + 457. Price Rs. 12.

A History of Luminescence from the Earliest Times Until 1900. By E. Newton Harvey. (The American Philosophical Society, 104, South Fifth Street, Philadelphia-6, Pa.), 1957. Pp. xxiii + 692. Price \$6.00.

Meprobamate and Other Agents Used in Mental Disturbances. By James G. Miller, Frank M. Berger and others. (Annals of the N.Y.A. Sciences, Vol. 67, Art. 10, pp. 671-894.) Price \$4.00.

The Mulching of Vegetables. By Patricia Rowedutton. (Director, Commonwealth Bureau of Horticulture and Plantation Crops, East Malling Research Station, Kent), 1957. Pp. xiv + 169. Price \$2.80.

SCIENCE NOTES AND NEWS

Transparent Magnetic Material

At the National Academy of Sciences, held in Washington, on April 22, 1957, the Bell Telephone Company exhibited the first transparent magnetic material, yttrium-iron garnet. A thin section of this material under a microscope with TV attachment was shown clearly exhibiting the distinct domains of the magnetic structure. It could be seen that the separate domains of opposite magnetic polarity rotated the plane of polarised light in opposite directions. Bringing a small horse-shoe magnet near the sample distorted the pattern of the domains and hysteresis could be seen as a visible phenomenon.

High-Pressure Jets

The remarkable properties of jets of liquid rushing out of nozzles at high pressure have long been known. If a stream of water ejected by a fire hose at a pressure of four to five atmospheres hits a stick, the stick breaks as if it had been struck by iron.

What happens, however, if the pressure goes up still higher? Soviet scientists working in

the U.S.S.R. Academy of Sciences Laboratory of Super-High Pressure have conducted experiments with a hydraulic compressor which produces a ton of water per hour at a pressure of 2,000 atmospheres.

The very first experiments have shown that in spite of the prevailing view, the jet leaving the nozzle at super-high pressure does not turn into a cloud or drops, but preserves its shape. The higher the scientists raise the pressure, the more compact is the shape assumed by the jet. When a knife blade is put in its way, a hole is bored through the 2-millimetre thick steel.

Under-water Gravimeter

A search for under-water oil deposits around Australia's coastline is to be pushed ahead with assistance of an instrument which will enable geophysicists to take gravity measurements under water. The gravimeter is enclosed in a massive steel bell, and procedure of operation is to lower it from a ship to the sea floor. The device is levelled by electronic means, and readings are taken from an electronic panel

located in a cabin of the ship carrying out the operation. It is claimed that the meter is so sensitive that it can measure differences in the force of gravity with an accuracy of one part in a hundred million.

Manchester University Radio-Telescope Starts Trials in United Kingdom

Observations made by the Manchester University radio-telescope at Jodrell Bank in the United Kingdom, which started operation early in August, are already showing new features in the pattern of radio emission from stars only previously detected by much more complicated instruments. In an experiment carried out recently, reception from a powerful radio-star in the constellation of Cassiopeia provided in two hours information which would previously have taken a month to collect.

Scientists carrying out trials with the Jodrell Bank telescope say that there is an almost complete lack of interference in operation, and records are much less ambiguous than those obtained with instruments previously in use.

Visiting Professorship

Dr. K. R. Ramanathan, Director, Physical Research Laboratory, Ahmedabad, has been invited to spend two months in the United States as a Visiting Professor at the University of Southern California. He will proceed to Los Angeles after attending the Meetings of the International Unions of Radio Sciences and of Geodesy and Geophysics respectively at Boulder, Colorado and at Toronto, Canada. He is expected to return to India in November.

Symposium on Utilisation of Indian Medicinal Plants

The above Symposium will be held at the Central Drug Research Institute, Lucknow, in the second week of October 1957, under the

auspices of the Pharmaceuticals and Drug Research Committee of the C.S.I.R.

University of Saugar

On the 5th of August the Vice-Chancellor formally opened the New Geology Building at the new University site. This is the first building to be occupied in the new site and for the time being it is being used by the Departments of Applied Geology, Geography and Anthropology. Situated high up on a plateau of Deccan Trap overlooking the town and lake, the University buildings will be visible miles around.

International Symposium on Enzyme Chemistry

Professor K. V. Giri will preside over one of the Sessions of the Symposium to be held at Tokyo from the 16th to the 23rd October 1957. He has also been invited to deliver lectures under the auspices of various scientific organisations in Japan.

The Indian Mathematical Society

The Twenty-Third Conference of the Society will be held in Cuttack in the last week of December 1957, under the auspices of the Utkal University. Those intend reading papers are requested to contact the Secretary of the Society, at 2, Bhaskarapuram, Madras-4.

Award of Research Degrees

The Andhra University has awarded the D.Sc. Degree in Chemistry to Shri V. Narayana Rao for his thesis entitled "Organic Reagents in Inorganic Analysis".

Messrs. Vishnu Mitte and S. C. D. Sah have been awarded the Ph.D. Degree by the Lucknow University on their theses, "Studies on the Fossil Flora of Nipania (Rajmahal Series), Bihar", and "Contributions to Jurassic Palaeobotany" respectively.

NOTICE

THE Offices of the Current Science Association have been permanently shifted to the Raman Research Institute, Bangalore-6.

All material intended for publication in *Current Science* and books for review may therefore be addressed hereafter to :

The Editor, *Current Science*,
Raman Research Institute,
Hebbal P.O., Bangalore-6.

Business correspondence, remittances, subscriptions, advertisements, exchange journals, etc., may be addressed as usual to :

The Manager, *Current Science Association*,
Raman Research Institute,
Hebbal P.O., Bangalore-6.

ORGANIC CHEMISTRY

9th Revised Edition

By P. B. SARKAR, D.Sc., F.N.I.

Director of Technological Research,
Indian Central Jute Committee

First Published 1942

9th Ed. 1957

vi+490 P. 8½×5½

Rs. 8

"Undoubtedly an asset in guiding the
students towards acquiring a proper under-
standing of the subject."

PROF. VED PRAKASH
Hindu College, Moradabad

INTERMEDIATE PHYSICS

By N. N. BASU & J. CHATTERJEE

16th Edition, 1956. In Two Vols. D/D Size

Lucid exposition, up-to-date information,
numerous worked out examples, all-India
examination questions, and neat diagrams
are the features of this standard work.
Popular all over India, Covers all-India
University syllabuses.

Rs. 6 Each Vol.

ENGINEERING ECONOMICS

By PROF. S. K. NANDI

Indian Institute of Technology, Kharagpur

WITH A FOREWORD BY

DR. J. C. GHOSH

Member, Planning Commission

Recommended as a Text-Book by Universi-
ties, Engineering Colleges and Technologi-
cal Institutions. Highly spoken of by eminent
educationists.

Rs. 8

INORGANIC CHEMISTRY

For Intermediate Students of Indian
Universities

By P. K. DUTT, M.Sc.

Prof. of Chemistry, Presidency College
Calcutta

5th Revised Edition, 1956, 550 pp. Rs. 6.25

A complete course, in lucid style, with up-
to-date information. The only book which
will cover the all-India University syllabus.

A TEXT-BOOK OF HEAT

(for Junior Students)

8th Revised and Enlarged Edition

By M. N. SAHA, D.Sc., F.R.S.

AND

B. N. SRIVASTAVA, D.Sc., F.N.I.

Prof. of Physics, Indian Association for the
Cultivation of Science, Calcutta

It commands a monopoly sale as the best
book on the subject and fully covers the
syllabuses of Indian and Pakistan Univer-
sities.
Cloth Bound, Rs. 9

ELEMENTARY PHYSICAL CHEMISTRY

10th Revised Edition, 1956

By SANTI R. PALIT, D.Sc., F.R.I.C., F.N.I.

Prof. of Physical Chemistry, Indian
Association for the Cultivation of Science
Calcutta

The book has been thoroughly revised and
made up to date. It meets the requirements
of Pass B.Sc. students of Indian and
Pakistan Universities.
Rs. 6.50

INTERMEDIATE CALCULUS

By K. C. BASAK, B.A. (Cantab.)

Director of Economic Research
Indian Central Jute Committee

Lucid treatment, numerous worked out
examples, covers all-India syllabus

Rs. 2.50

INORGANIC CHEMISTRY

By P. RAY, M.A., F.N.I.

Formerly Palit Prof. of Chemistry
University College of Science, Calcutta

An authoritative text on the subject
covering the B.Sc. syllabuses of Indian and
Pakistan Universities. The book is expected
to excel all other publications and remove
a long-felt want.
Rs. 11

H. CHATTERJEE & CO. (PRIVATE) LTD.

19, SHYAMA CHARAN DE STREET, CALCUTTA 12

Telephone: No. 35-2052

Estd. 1922

Telegrams: 'Jabakara', Calcutta

Very reliable indigenous substitutes of G.R. Quality Analytical Reagents with Guaranteed Test Reports may be found in as per I.S.I. Specifications in

OSTER'S PRODUCTS

ACID HYDROCHLORIC A.R.S.G. 1·18

Container.....Resistance glass
Residue.....0·0015%
Sulphate (as H_2SO_4)....0·0003%
Iron Compounds (as Fe)....0·0001%
Free Chlorine and Bromine....0·0002%
Sulphite (as SO_3)....0·003%
Arsenic (as As_2O_3)....0·000005%

ACID NITRIC A.R.S.G. 1·42

Container.....Resistance glass
Residue.....0·001%
Chloride (as HCl)....0·0001%
Sulphate (as H_2SO_4)....0·0005%
Other Laboratory Chemicals

ACID SULPHURIC A.R.S.G. 1·42

Container.....Resistance glass
Residue on ignition....0·0025%
Iron (as Fe)....0·0001%
Chloride (as Cl)....0·0003%
Heavy metal (as Pb)....0·0002%
Arsenic (as As_2O_3)....0·0001%

AMMONIUM HYDROXIDE A.R. 900

Container.....Resistance glass
Non-Volatile....0·002%
Chloride....0·0001%
Sulphate....0·00054%
Other impurities pass limit tests

Apply for Agency Terms and Catalogues to:

Sri Chunilal Datta, B.Sc., Formerly Senior Demonstrator of Chemistry
VIDYASAGAR COLLEGE, CALCUTTA

Managing Director:

Oster Chemical & Pharmaceutical Works (Private) Ltd.

Registered Office:

78 B, Manicktola Street, Calcutta-6

Chemical Works:

Bagmari Road, Calcutta

C.S.I.R.'S LATEST PUBLICATION

HIGH-CALCIUM LIMESTONES OF INDIA

Their Chemical and Physical Properties
and
Uses in Chemical Industry

By

Dr. H. C. BIJAWAT & Dr. S. L. SASTRY

117 Pages

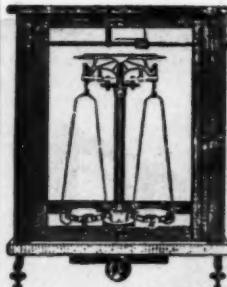
29 Illustrations

Price Rs. 5·00



Available from:

THE SALES AND DISTRIBUTION OFFICER
PUBLICATIONS DIRECTORATE
Council of Scientific & Industrial Research
OLD MILL ROAD, NEW DELHI 2



KEROY
Short Beam
Analytical
Balance

No. K 1

A Really Dependable Balance for Degree Classes and Research Laboratories

Sensitiveness ... 1/10th mg.
Capacity ... 200 gm.
Fitted on $\frac{3}{8}$ " thick glass base Price: Rs. 325/-
Catalogue on Request

Manufactured by:

KeroY (Private) Ltd.
BANARAS CANTT. :: CALCUTTA 10
"Calcutta Telephone No. is 24-3840."

THERMOSTATIC BATHS

(WATER OR OIL)

Various sizes and temperature ranges for general laboratory work. Maximum dimensions $18'' \times 18'' \times 12''$. Maximum temperature upto 300° C. Accuracy of control to within $\pm 0.05^{\circ}$ C. Efficient Stirring, with glass walls on two sides for good visibility, and metal framework for strength. Switch-board and control box attached to one of the sides.

Entirely Our Manufacture

For full particulars, please write to :

**THE GENERAL
ENGINEERING AND SCIENTIFIC CO.**

WALTAIR, VISAKHAPATNAM-3

(S. INDIA)

Technical Adviser :

Dr. I. RAMAKRISHNA RAO
M.A., Ph.D. (Cal.), D.Sc. (Lond.)

All In One
INDEX
REAGENT BOTTLES
made by
Sigcol



Sole Distributors
GHARPURE & CO.
P.S. ROYAL EXCHANGE PLACE
EXTENSION - CALCUTTA-1

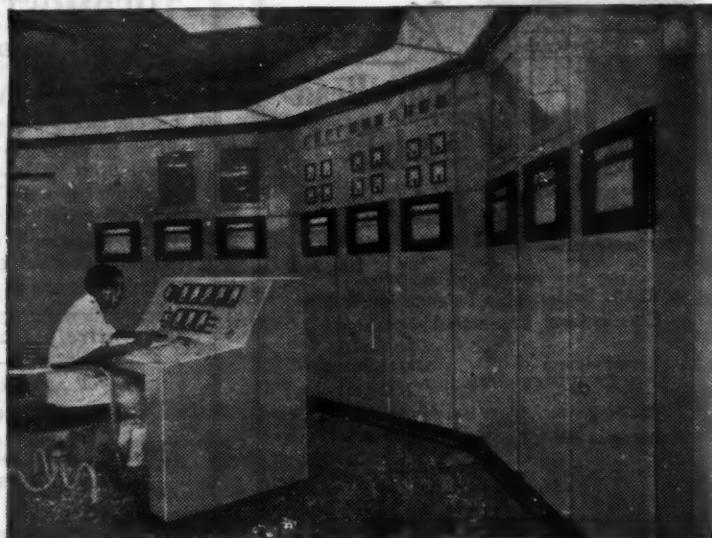
GRAM-MEEHAMO PHONE-222061

**VERY RELIABLE INDIGENOUS SUBSTITUTES
OF GUARANTEED ANALYTICAL REAGENTS
MAY BE FOUND IN**



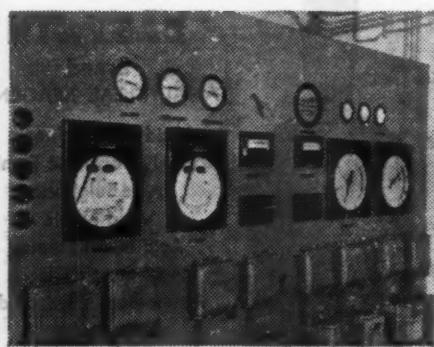
"BASYNTH"
Brand
ANALYTICAL REAGENT

Acid Hydrochloric
Acid Hydrochloric Fuming
Acid Sulphuric
Acid Nitric
Acid Nitric Fuming
Acid Acetic Glacial
Ammonium Hydroxide
Benzene
Toluene
Xylene
Petroleum Ether
Amyl Alcohol
Butyl Alcohol Etc., Etc.
Basic & Synthetic Chemicals (Private) Ltd
P. O. Jadavpur College, Calcutta-32



View of the CONTROL ROOM: HONEYWELL Strip Chart ElectronIKs continuously record critical variables such as coolant temperature and flow, log flux, reactor period, rod position, etc.

Honeywell Instrumentation on India's (and Asia's) first Nuclear Reactor



In the PUMP ROOM,
HONEYWELL Indicators and
Recorders measure flows,
temperatures and conductivity.

India's first Nuclear Reactor has been designed for the training of nuclear engineers and for peace time research.

Honeywell instruments play a vital part in the operation of the Reactor, permitting reactions to be safely controlled and continuously recorded.

Apart from reactor research, Honeywell's versatile ElectronIK instruments are used in many of the ancillary research departments of the Atomic Energy Establishment—including those concerned with chemical engineering, health monitoring, physics, electronics, chemistry and metallurgy.



BLUE STAR

BLUE STAR ENGINEERING CO. (Madras) PRIVATE LTD.
23/24 SECOND LINE BEACH, MADRAS I
Also at BOMBAY, CALCUTTA, DELHI

Through a filter paper's pores No.2



cotton cellulose

... for accurate analysis

Whatever the procedure, quantitative analysis cannot end more accurately than filtration begins. By presenting an unchanging face to the solvents and reagents used, Whatman cotton cellulose Filter Papers reduce the risk of error.

All Whatman papers are manufactured from the purest form of cellulose—that derived from best quality, bleached cotton fibres. Unlike papers made from cellulose of different origin, they contain an absolute minimum of organic contaminants. Organic estimations can thus be based on Whatman papers with purity guaranteed from the start.

Whatman paper is also freer from metallic salts than many Analytical Grade reagents. It therefore ensures that a chemically clean precipitate will always be obtained when work is done on inorganic substances.

The entire range of Whatman Filter Papers is discussed in the booklet 'Buyers' Guide.' Copies of this booklet, and of that containing the first series of monographs on Chromatography, can be obtained from the address below.

It would be of assistance if you would quote the reference FS2 when replying to this advertisement.

J. REEVE ANGEL & CO LTD • 2 BRIDEWELL PLACE • LONDON • EC4

also at 52 Duane Street New York 7

sole distributors of

WHATMAN FILTER PAPERS

(M. 642. W. G. B. Balcom, Jr.)

TEMPO LABORATORY EQUIPMENT



HOT AIR OVEN

TEMPO INDUSTRIAL CORPORATION (PRIVATE) LTD.

Sonari Road, Paranjpe 'B' Scheme, BOMBAY-24

-RELIABLE HOUSE FOR-

- ◆ LABORATORY GLASSWARES
(Plain and Graduated)
- ◆ THERMOMETERS & HYDROMETERS
(Various ranges)
- ◆ LABORATORY PORCELAINWARES &
SILICAWARES
- ◆ NICKEL AND PLATINUMWARES
- ◆ WHATMAN FILTER PAPERS
- ◆ MICROSCOPES & ACCESSORIES
- ◆ BALANCES, TINTOMETERS, AEROGEN
GAS PLANTS AND OTHER INSTRU-
MENTS REQUIRED BY CHEMICAL
LABORATORIES

Contact:

UNIQUE TRADING CORPN.

51-53, Baba Gazi Road
BOMBAY 2

Gram: 'UNILAB'

Phone: 30011

For
ZOOLOGICAL SPECIMENS
AND
BIOLOGICAL REQUIREMENTS
OF THE
LABORATORIES
AND
INSTITUTIONS



Consult:

Bombay Biological House

Dealers in Zoological Specimens

119, Hindu Colony, Dadar, BOMBAY 14

Established 1941

Phone: 61813

Gram: PHERETIMA

BOROSIL LABORATORY GLASSWARE

such as

FLASKS, BEAKERS, CONDENSERS,
MEASURING FLASKS, MEASURING
CYLINDERS, PIPETTES & ANY
SPECIAL APPARATUS MADE TO
DESIGN

and

PENICILLIN VIALS, VACCINE BULBS-
WHITE & AMBER



ALL OTHER APPARATUS & EQUIPMENT
MANUFACTURED TO CLIENT'S DESIGN

INDUSTRIAL & ENGINEERING APPARATUS CO. (PRIVATE) LTD.

CHOTANI ESTATES, PROCTOR ROAD
GRANT ROAD, BOMBAY 7

BAUSCH & LOMB

CERTIFIED-PRECISION

Diffraction Gratings

- * Each Bausch & Lomb "CP" Replica Grating is equal or superior to the master grating from which it was made.
- * A minimum of Rowland ghosts.
- * Satellites negligible or completely absent.
- * Gratings available in a wide range of numbers of grooves per mm.
- * Plane Reflectance, Plane Transmission, or Concave Gratings.

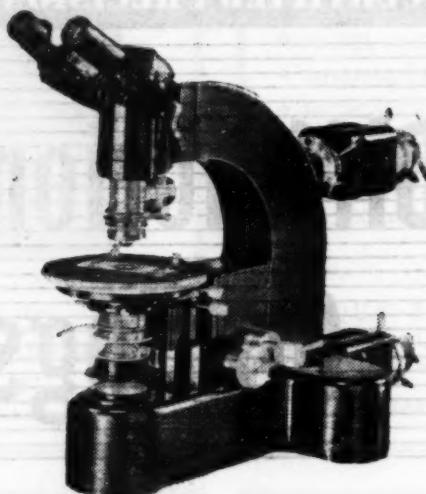
Manufactured by

THE BAUSCH & LOMB OPTICAL COMPANY
ROCHESTER, N.Y., U.S.A.

Sole Agents

MARTIN & HARRIS (PRIVATE) LTD.
(SCIENTIFIC DEPARTMENT)
SAVOY CHAMBERS, WALLACE STREET
BOMBAY 1

E.LEITZ
WETZLAR



Leitz

ORE DRESSING MICROSCOPES

Offer excellent scope for assessment and investigation of ore dressing products of larger as well as smaller particle size. They serve for the determination of transparent and opaque minerals whose presence in the dressing process is already known as also recognition of the presence of unexpected minerals from important external characteristics, *viz.*, colour, reflectivity, crystal form, surface condition, cleavage, fracture, intergrowths, etc.

For further information please write to:

The Sole Distributors:

THE SCIENTIFIC INSTRUMENT COMPANY, LTD.

ALLAHABAD BOMBAY CALCUTTA MADRAS NEW DELHI

